Assessment of Neonatal Nurse Practitioner Workload in a Level IV Neonatal Intensive Care Unit

DNP Final Project

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Nursing Practice in the Graduate School of the Ohio State University

By

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2015

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Abstract

The neonatal nurse practitioner (NNP) is a direct care provider in the neonatal intensive care unit (NICU), with responsibilities for patient care management and supervision of physician fellows and residents, and monitoring the care activities performed by the nurse with the patient and family. In recent years, regulations have been set in place to limit the number of patients for whom a resident should provide care. This has resulted in more neonates left to the care of the NNP, and fellows who have less clinical experience than was true in the past. There are no standards or processes for determining the assignments of the NNP, and assignments seldom account for the acuity of the patients. The purpose of this DNP Final Project was to describe the assignment patterns of the NNPs in a 59-bed level IV NICU in a freestanding academic children's hospital located in the Midwest region of the United States. Twenty-five NNPs responded to an electronic survey at the end of each worked shift during the project period. The following objective measures were utilized to describe the workload during a worked shift: (a) number of NNPs assigned to the shift, (b) caseload, (c) patient acuity, (d) experience and competence of the NNP, (e) perception of safety, and (f) level of satisfaction of the NNP in relation to assignment factors.

The project was designed to describe NNP activity in one level IV NICU using an electronic survey completed by each NNP at the conclusion of the worked shift. The survey captured (a) caseload, (b) patient acuity, (c) additional duties and responsibilities, and (d) the perception of the NNP regarding safety and satisfaction. Participants were provided an opportunity to enter a narrative comment to explain the rating. At the initiation of the project, the participants completed an individual demographic survey identifying years of experience in

the NICU and level of NNP competence using Benner's levels of skill acquisition. Descriptive statistics and correlations were used to analyze the resulting data.

Participants reported satisfaction with performance with a mean rating of 2.2 (N=45, standard deviation (S.D.) =0.7) in week 1, and 1.67 (N=4, S.D.=0.8) in week 2. Participants reported satisfaction with patient outcome with a mean rating of 2.09 (N=45, S.D.=0.8) in week 1, and 1.65 (N=43, S.D.=0.8) in week 2. There was a weak correlation between satisfaction with performance and, patient acuity score ($r=0.24$, $p\leq0.001$ in weeks 1 and 2), and patient caseload number ($r=0.02$, $p\leq0.001$ in week 1, and $r= -0.13$, $p\leq0.001$ in week 2); and between satisfaction with patient outcome and, patient acuity, ($r=0.19$, $p\leq0.001$ in week 1, and $r=0.25$, $p\leq0.001$ in week 2), and patient caseload number ($r= -0.23$, $p\leq0.001$ in week 1, and $r= -0.17$, $p\leq0.001$ in week 2). Though the participation of the NNPs was strong, there were limited data to yield a significant relationship of the measures to satisfaction and patient acuity.

The data reported are those from the first two weeks of an ongoing project, and considered only one of the many possible questions. The implication of this project for NNP practice was to monitor a baseline of activity describing and measuring the workforce, workload, caseload and satisfaction. Change measures should be based on the continual evaluation of objective measures to sustain a culture of safety, optimum outcome and NNP satisfaction.

Acknowledgements

This author would like to extend a special note of appreciation to my Advisor, Thelma Patrick, PhD, for the time and direction given me during this project; and to Joyce Zurmehly, PhD, and Jacalyn Buck, PhD, RN, for their encouragement and support. Their counsel and advice was a strong motivator.

This project would not have occurred had it not been for the faith and persistence of Cindi Acree-Hamann, DNP, Heather Ryle, DNP, Ashley Warfel, MSN, Nancy Roberto, MSN, and the dedicated Neonatal Nurse Practitioners at the Cincinnati Children's Hospital Medical Center. Our motto, "cooperate to graduate", was inspirational.

My family, Jim, Zach, Erin and Mom, gave of themselves to fortify me with energy and enthusiasm. Their strength reinforced my resilience to sustain.

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Chapter One: Nature of the Project

The project, "Assessment of Neonatal Nurse Practitioner Workload in a Level IV Neonatal Intensive Care Unit", describes the actual workload assignment process of the Neonatal Nurse Practitioner (NNP) through the application of objective factors that affect the workload in the context of a dynamic acute care operational setting. Chapter one includes (a) background about the utilization of the NNP in the NICU as a provider of critical care, (b) the significance of assessing NNP workload, (c) a review and evaluation of the evidence pertinent to the problem, (d) the design and collection of data, (e) the findings, and (f) the implications of the project.

Introduction to the Project

Infants cared for in the neonatal intensive care unit (NICU) are the most vulnerable of the hospitalized infants (American Academy of Pediatrics & the American College of Obstetricians and Gynecologists [AAP & ACOG], 2012; American Academy of Pediatrics Committee on Fetus and Newborn [AAP COFN], 2012). Because of the complexity of care required by NICU infants, their fragile medical status, and their anatomic and physiologic immaturity, the provision of care to them is highly dependent on the distribution of knowledgeable, qualified and experienced staff. The shortage of neonatologists in the 1970's prompted the development of NICU nurses and NNPs with extended skills to manage patient stabilization, transport, and crisis events. The education and the role of the NNP in the NICU have evolved to continue to meet changing workforce needs (Cusson et al., 2008; National Association of Neonatal Nurse Practitioners, 2013).

The demand and responsibilities for NNPs has been affected by the reduction in hours on duty and/or infants that may be assigned to medical residents in the NICU. In a survey of 114 freestanding children's hospitals or children's hospitals within a larger hospital, 42% (N=27) of the respondents reported increasing the NNP workforce to compensate for the 2011 medical resident work hour restrictions, and 43% (N=27) plan to hire additional NNPs over a 2-year period to further address the changes (Freed, Dunham, Moran, & Spera, 2012). Over time, the responsibilities enacted by the physician, fellow and resident in the health care environment have resulted in fewer hours when a physician is active in direct patient care. The NNP functions as a provider to fill the critical gaps in care (Association of Women's Health, Obstetrics & Neonatal Nurses [AWHONN], 2010; Accreditation Council for Graduate Medical Education [ACGME], 2011; Starmer et al., 2010; Freed, Dunham, Moran, & Spera, 2012). There are nursing practice standards that recommend the number of direct nurse caregivers, and increasingly stringent restrictions on the number of infants that can be managed by a resident physician. These standards were established to enhance the safety of the infants and the well-being of the staff. However, there are no standards, and a limited understanding of the factors that guide the allocation of NPP workload for many reasons, including: (a) the decline in resident physician duty hours in the NICU as described, (b) advances in the science of medicine and technology rapidly emerge, (c) neonatal admissions continue to increase, and (d) more time is needed to support the fellow and attending physician to perform safe, quality patient management (ACGME, 2011; Freed, Dunham, Switalski, Jones, & McGuinness, 2009). In the absence of such standards, there is an increasing demand, but limited supply, of NNPs, resulting in concern for the utilization of NNPs to fill critical infant needs.

Significance of the Project to Nursing and Health Care

The advanced practice registered nurse (APRN) is the title of a professional healthcare leader who is (a) educated at the master's and doctoral level, (b) certified within a specialty population focus area, (c) licensed by the state to practice and prescribe in accordance with the regulated scope, and (d) credentialed by the governing board of the practice facility. In Ohio, APRNs are required to have a signed and documented collaborative agreement (standard care agreement) with the physicians with whom they practice (Advanced Practice Registered Nurse Certification & Practice, 2014). In general, the primary roles of the APRN are (a) Nurse Practitioner, (b) Clinical Nurse Specialist, (c) Nurse Midwife and Nurse Anesthetist (National Council of State Boards of Nursing [NCSBN], 2008). APRNs also function as nurse educators, nurse researchers, and faculty. This project is focused on the role of Nurse Practitioner.

Competency

The educational preparation of the APRN, master's or doctoral, does not impact or change the scope of practice for the advanced practice nurse. The National Organization of Nurse Practitioner Faculties (NONPF) defines basic preparation and competency expectations for each specialty focus area. The Nurse Practitioner Core Competencies are "guidelines for educational programs preparing NPs to implement the full scope of practice as a licensed independent practitioner" (National Organization of Nurse Practitioner Faculties [NONPF], 2013, p. 1). The competencies guide the development of APRNs to critically process complex situations by translating knowledge and data into practice, and function within changing contexts and environments (NONPF, 2013).

APRN practice competency in the area of population-foci (specialty) is monitored by the national certification organizations and the facility of employment credentialing committee.

Standardized testing is done initially to assure competence, and at regular intervals by the certification organizations in conjunction with a requirement for continuing education. The health facility credentialing committee monitors competency through a process of focused professional practice evaluation and ongoing professional practice evaluation (FPPE/OPPE) required by The Joint Commission (TJC) (The Joint Commission [TJC], 2011). The evaluation metrics are determined by the facility medical executive governing body. Each practitioner must be evaluated by peer review more than twice a year.

Scope of Practice

The American Association of Nurse Practitioners (AANP) defines the scope of practice for the nurse practitioner (NP) as a "licensed, independent practitioner who practices in ambulatory, acute and long-term care as primary and/or specialty care providers." NPs diagnose, manage acute and chronic illnesses, and promote health and disease prevention. Services that the NP is authorized to provide clients(s) and their support persons include: (a) ordering, conducting, supervising, and interpreting diagnostic and laboratory tests; (b) prescribing pharmacologic agents and non-pharmacologic therapies, and (c) teaching and counseling. NPs practice autonomously and in collaboration with other interprofessional health providers and caregivers to assess, diagnose, treat and manage client needs. In addition, NPs serve as researchers, interdisciplinary consultants, and patient advocates. They are self-directed and continuous learners accountable for healthcare outcomes and responsible to the changes in healthcare (American Association of Nurse Practitioners [AANP], 2013, p. 1).

Practice

In the practice setting, the care management functions of the NP closely resemble those of the medical discipline, such as physician resident, fellow and attending. The framework for

practice, however, is that of the nursing discipline. Medicine is oriented to the cure aspect of disease pathology. Nursing is oriented to the holism of the person and the improvement of the individual's health status within his/her environment (Nightingale, 1946, p. 4-6; Zaccagnini & Edinger, 2011, p. 350-351). The APRN is prepared to independently manage patients within the scope of practice without the approval, or authority, of another discipline. The two professionals serve patients/clients as a complement to one another in a collaborative practice relationship that benefits the health status of the individual within his/her life system. To date, independent APRN practice is recognized in 16 states of the United States (Institute of Medicine [IOM], 2008; National Association of Neonatal Nurse Practitioners [NANNP], 2014; American Association of Colleges of Nursing [AACN], 2014).

Quality of Practice

There is an abundance of evidence to support the delivery of care by the APRN in a (a) safe (Newhouse et al., 2011; Brown & Grimes, 1995), (b) cost effective (Allred, Arford, Bellig, & Bissinger, 1997), (c) efficient (Beal et al., 1999; Fry, 2011; Jackson et al., 2003), (d) equitable (Karlowicz & McMurray, 2000), and (e) quality-bound (Newhouse et al., 2011; Mundinger et al., 2000; Laurant et al., 2005) manner. The IOM Report, *The Future of Nursing: Leading Change, Advancing Health* cites references from numerous and diverse reputable sources regarding the efficacy of health care delivered by the APRN in a variety of acute and primary care settings (IOM, 2008). A systematic review of APRN outcomes from 1990 to 2008 in the United States published by Newhouse et al. found that "care provided by NPs and Certified Nurse Midwives (CNM) in collaboration with physicians is similar to and in some ways better than care provided by physicians alone for the populations…" (Newhouse et al., 2011, p. 1). The

review concluded that APRNs can provide safe, effective, quality care to multiple populations across many health settings.

This author performed a search of the Cochrane Database of Systematic Reviews using the key words, NP and quality of care. A total of 8507 articles were found for review. Sixteen (16) articles were selected to describe the quality of care delivered by NPs in the areas of primary care, asthma, diabetes mellitus, surgery, anesthesia and chronic conditions. Laurant et al. evaluated the impact of doctor-nurse substitution in primary care from 1966 to 2002 on the following outcomes: (a) patient outcomes, such as morbidity, mortality, satisfaction, compliance and preference; (b) process of care, including practitioner adherence to clinical guidelines, standards or quality of care, and practitioner health care activity; and, (c) resource utilization, including direct and indirect costs, frequency and length of consultations, return visits, prescriptions, tests and investigations, and referral to other services. The findings indicated that there was no appreciable difference between doctors and nurses for the variables measured. There were positive differences with nurse-led teams relative to: (a) patient satisfaction, (b) shorter wait time for initial contact with urgent-need patients, (c) more time spent with patients, and (d) health information provided to the patient. Salary differential and workload productivity was variable among the site locations thus limiting the opportunity to synthesize the data to achieve meaningful comparison (Laurant et al., 2005).

Garland et al. (2013) described alternative staffing models in the adult and pediatric ICU compared with the round-the-clock intensivist model. Partial coverage by a hospitalist (night shift) revealed no significant difference in outcome from the round-the-clock intensivist staffing model. Resident coverage on nights in the ICU showed higher patient mortality and LOS, and more errors. The utilization of non-physician providers, such as the NP, in collaboration with the

physician team, did demonstrate positive outcomes. Because the NPs assume responsibility for monitoring outcomes, and adjusting patient management plans based on the outcome data, it was noted that there were reductions in mortality, LOS, duration of mechanical ventilation, complications, and costs. The authors concluded that interprofessional collaborative practice in the ICU is as effective, or better, than the round-the-clock coverage of patients by the intensivist. The essential elements the NP brings to the collaborative practice team for the management of critical care and the improvement of patient outcome include: (a) consistent presence to improve communication among the healthcare team, (b) adherence to clinical practice guidelines to reduce practice variability, (c) procedural proficiency, and (d) high-level expertise in ICU care that comes from consistent exposure (Garland & Gershengorn, 2013).

Neonatal Practice

The sub-specialty of neonatology is a young science. The first neonatal intensive care unit was developed in the 1960's. In the 1970's, neonatal care was organized by graduated levels of risk, acuity, and resources. The standardized definitions have changed with the science and the practice. The levels are currently defined as: (a) Level I, which is basic care to neonates at low-risk; (b) Level II, which indicates moderate care to neonates born ≥32 weeks gestation or ≥1500 grams; (c) Level III, which adds medical and surgical sub-specialty support to neonates <32 weeks gestation and <1500 grams; and (d) Level IV, which has the capability to manage most complex and critically ill neonates of any gestation or weight with 24-hour availability of sub-specialty support (AAP COFN, 2012).

The role of the NNP was initiated in the 1970's, and has evolved from successfully supporting neonatal healthcare, to becoming the care provider. The neonatal inpatient population has shown a dramatic increase over the years. Subsequently, the supply of physicians, fellows

and medical residents has failed to keep pace with the clinical demand. Given the changes in workforce, the quality of care delivered to complex patients in the NICU by NNPs is well documented in the literature as early as the 1990's (Allred et al., 1997; Mitchell-DiCenso et al., 1996; DiCenso, 1998; Hall & Wilkinson, 2005; Woods, 2006; Newhouse et al., 2011). The literature supports the preparation of the NNP with an appropriate level of didactic knowledge and performance skill to manage the needs of neonatal patients and their families (Bellini, 2013; Honeyfield, 2009; DiCenso, 1998; Juretschke, 2003; Freed et al., 2012). As one of the more established advanced nursing practice roles, the NNP has successfully progressed from supervision by the neonatologist, to autonomy as an independent healthcare provider.

A survey published by the National Association of Neonatal Nurses (NANN) in 2012 reported that NNP caseloads exceed ten (10) patients per shift in a tertiary service; and, NNP worked shifts lengths are equally divided between 12 and 24 hours, generally exceeding 40 hours in a week (Timoney & Sansoucie, 2012). Extended work hours and large patient caseloads in the NICU causes fatigue which can lead to diminished mental acumen and physical agility for the NNP when required to make timely critical decisions. Potential distractors for the NNP, as reported in the survey, were additional workload responsibilities and activities performed during the shift, to include: (a) precepting students and orientees, (b) supervising residents, (c) performing procedures, (d) transporting babies to procedures, (e) responding to crisis events, (f) admitting and discharging infants, (g) providing consultations, (h) attending high risk deliveries, (i) managing and coordinating NNP group activities/scheduling, (j) leading improvement projects, and (k) conducting continuing education sessions for staff and colleagues.

A more recent survey of 1300 NNPs from across the United States, reported that patient caseload exceeded the level that the respondents considered to be safe. Greater than half of the

respondents from Level IV NICUs indicated that an average caseload of 6 patients was unsafe (Meier & Staebler, 2014). Additional workload responsibilities and activities expected of the NNP during the work shift makes it difficult to concentrate on the complexity of the patient situation, and the simultaneous interaction of two or more patient situations. Further evidence corroborates this reported finding (Cusson et al., 2008; DiCenso, 1998; Frank, Mullaney, Darnall, & Stashwick, 2000; Smith & Hall, 2011). NNPs assume professional development opportunities on personal time, and frequently, at personal expense. Sleep deficit together with distractions can negatively influence the process of decision-making, prioritization, and time management; and, consequently, affect patient safety (National Association of Neonatal Nurse Practitioners [NANNP], 2012).

Definition of Terms and Roles

In the healthcare environment, the workforce is defined as the resource of personnel, specifically the health care roles that manage or perform care to/with the client (Institute of Medicine [IOM], 2010). The active process of the workforce is staffing, aligning the personnel resource with the patients/clients who require care management. In the NICU, the roles include multiple professionals who are direct caregivers, such as nurses, and direct care providers, including physicians, medical fellows and residents, and NNPs. The patients in the NICU are newborns with a variety of clinical diagnoses, and levels of complexity and acuity. This project focused on the role of the NNP as a direct care provider.

The physician, nurse practitioner and nurse are professionals functioning in the health care environment within the full scope of their licensed role. The roles differ. Medical fellows and residents are trainees in the process of completing educational requirements, and consequently, are not empowered to function at the same level of role responsibility and

accountability as the physician. The scope of practice for the physician and nurse practitioner authorize the professionals to manage client care by prescribing a plan of care to include: (a) diagnostic therapeutics, (b) pharmaceuticals, and (c) procedures, and (d) direct billing for the care provided (National Association of Neonatal Nurse Practitioners, 2013). The scope of practice for the registered nurse does not authorize the act of prescribing. Nurses provide continual care by assessing, planning, implementing and evaluating the client for input to the prescribed diagnostic and treatment plan.

The term workload is defined as the responsibilities that are managed and performed by the professional within a given time period, such as worked hours. The professional is accountable to perform at personal best, mentally and physically, within the authorized scope of practice. This includes responsibilities and activities related to clinical care, education, research, professional development, management, coordination, and/or administration (National Association of Neonatal Nurse Practitioners, 2013).

In the context of the operations of a healthcare organization, Fieldston et al., (2014) refers to workforce as the "capacity" to meet "demand", such as workload, to "optimize efficiency" (p. 1). Balancing the dynamics of assigning staff, based on individual capability or competence, to patients with variable complex needs, requires a timely working knowledge of the workforce and the workload. The components that need to be considered during the staffing assignment process include: (a) personnel availability and competence, (b) census activity such as admissions, discharges, transfers and procedures; (c) patient diagnosis, intervention and acuity; (d) unexpected events that affect staffing and patient condition; and (e) environmental factors, such as the physical size and configuration of the unit, and the proximity of patients to the workforce provider.

Caseload is the term that defines the number and type of patient managed by the professional. In the NICU, caseload for a provider would be the number of complex patients managed within the worked hours. Patient type may be described by diagnosis, acuity/severity of illness, or category, i.e. level of care (AAP COFN, 2012).

Allocation of NNPs in the Work Environment

In 2010, as a member of the Council of the National Association of Neonatal Nurse Practitioners (NANNP), this author served as chairperson and lead author of the committee that drafted the consensus statement on Neonatal Nurse Practitioner (NNP) Workforce (National Association of Neonatal Nurse Practitioners, 2013). The review of the evidence about the NNP as a health provider in the NICU workforce, the workload of the NNP on a worked shift, and the caseload of patients managed by the NNP, showed that the NNP positively influences the quality, outcomes and cost-effectiveness of care to patients in the NICU (Allred et al., 1997; Juretschke, 2003; Hall & Wilkinson, 2005; Mitchell-DiCenso et al., 1996; Karlowicz & McMurray, 2000; Fry, 2011; Mundinger et al., 2000). The evidence used to recommend an NNP caseload was derived from the findings of the 2011 NNP Survey, and the medical resident caseload for the NICU recommended by the ACGME at that time (2011). The consensus of the NANN Board of Directors and the NANNP Council was a NNP caseload of 6-10 for the advanced beginner through expert level of competence, with adjustments made to caseload based on the following considerations: (a) patient acuity, (b) potential for crisis events, (c) concurrent leadership activity, (d) patient rounds, (e) parent/family education and communication, and (f) other patient areas to be covered (Timoney & Sansoucie, 2012; ACGME, 2011; National Association of Neonatal Nurse Practitioners, 2013).

The position statement cautions that there is limited evidence to recommend a safe and appropriate patient caseload or workload for a NNP in the NICU, and that further study is needed. This was further substantiated in an open discussion with NNPs at the annual National Association of Neonatal Nurses Conference (Jaeger et al., 2012). Methods to record and/or estimate actual function, such as relative value units (RVU) and "time and motion studies of APRN roles have been limited and less useful because APRNs are often combined with physicians or residents and only direct patient time is included, thus excluding large volumes of time spent in the roles the APRN fulfills that are not associated with direct patient care" (National Association of Neonatal Nurse Practitioners, 2013, p. 4).

Current practice in many organizations is to budget resources based on the historic (usually previous year) census and NNP-to-patient ratio. Schedules allocate the budgeted number of NNPs per shift, minus vacant positions, illnesses, leaves of absence, and vacations. Shift schedules and daily assignments are prepared from the number of available NNPs. There are times when there are unfilled needs for NNPs in a specific clinical setting based on the current patient number and status and the number of scheduled NNPs. To address these needs, requests are made for extra-time/overtime from the employed part-time, full-time and contingent NNPs. Patient acuity and additional responsibilities are not planned for in scheduling NNP caseload/workload assignments. Other factors that are not generally considered include the experience, competence and skill performance level of the NNP.

The measure of productivity by the NNP is difficult because the NNPs are not evaluated as a separate group. Provider productivity is generally linked with physicians; and physician productivity is associated with patient charges and overall census related to the specialty. The majority of NNPs do not bill directly for patient services (Timoney & Sansoucie, 2012). Since

neonatal charges are bundled and can be billed directly by only one provider, the responsibility is allocated to the admitting physician. Consequently, the revenue for the professional fee is routed to medicine specialty services to support physician salaries and expense.

Since the publication of the NNP Workforce position statement, NICU NNP groups are initiating unit projects to describe the caseload and/or workload of the NNP. Findings have been reported at national meetings during poster sessions and abstract presentations; few have been published. There continues to be a lack of consistency or standardization of tools and process to assess caseload and/or workload; and the descriptors and metrics vary. A baseline of real-time NNP caseload and workload activity is necessary at the unit level to gain a system perspective before change can be strategically designed, implemented and evaluated. Then, a search of the literature can provide evidence for opportunities to design incremental practice change to improve NNP caseload and workload. For this DNP project, an assessment of NNP workload at the unit level will be implemented to describe the activity of the NNPs in the NICU.

Purpose of the Project

The purpose of the project is to assess the process of planning and assigning workload during the worked shift to the NNP as a primary provider of complex care management in one NICU. The awareness of current operations and performance is a powerful stimulus for NNPs to own the process, identify problems, and initiate improvement to practice.

Organizational Interest

This project is a collaboration between the author and the NNP leadership team of a Level IV NICU at an academic freestanding Level IV NICU located in the Midwest region of the United States (AAP COFN, 2012). The unit is part of an organization that received Magnet designation, an indicator of the quality of the practice environment for nurses, in 2009 (American

Nurses Credentialing Center website, n.d.). It is a high reliability organization that encourages professionals to continually improve the value of the workforce through professional performance, health care outcome and cost-effectiveness.

The NICU is in the process of changing the provider model of care. The number of medical residents will be reduced by reallocation as of July 1, 2015 in accordance with the ACGME standards of 2011, and the NNPs will assume the patient caseload. To address this void, some NNP full-time equivalent positions have been budgeted and hired, but without strong evidence or a standard of NNP workload, it is difficult to determine if the additional workforce will support the patient census and acuity. It is important that the NNPs perceive that they can manage the additional workload of complex care management so that patients achieve a safe and optimum outcome.

Objectives of the Project

The objectives of the project are designed to obtain a short-term representation of the dynamic process of patient care management by the NNP in a level IV NICU before the change occurs in the provider model. The aims include: (a) identify the NNP workload using objective measures; (b) recognize the perception of the NNP relative to performance, patient outcome, and safety and satisfaction; and (d) compare the findings to professional recommendations.

Clinical Practice Question

How does a patient assignment made by standard practice methods affect overall satisfaction for the NNP in a Level IV NICU?

Chapter Two: Review of Literature

The review of the evidence in CINAHL, MEDLINE and the Cochrane Databases, was done using the key words: advanced practice nurse, neonatal nurse practitioner, physician, neonatologist, fellow, medical resident, nurse, advanced nursing practice, neonatal intensive care, neonate, infant, workload, workforce, caseload, neonatal acuity, competence, skill acquisition, quality, and safety. A broad search of key words was used to identify evidence closely associated to NNP workforce, workload, responsibilities, competence and patient caseload because metrics and processes specific to the NNP are not standardized, and often integrated with other roles and disciplines.

The terms were searched individually and in combination to determine the type, level and applicability of the evidence to the project. The search included published evidence from 1990 to the present, and included international publications. A total of 4979 articles were identified and 1525 articles were reviewed. When applicable, the more recent evidence was chosen.

There were 112 articles selected as evidence for this project because the articles provided information on one or more of the following: (a) descriptors of the APRN/NP/NNP as a provider in the critical care practice setting, (b) workload and/or caseload of providers/caregivers in the critical care setting, (c) descriptors of critical care patient acuity/severity-of-illness, (d) competence and skill acquisition evaluation, (e) impact of staffing on the quality, safety and outcome of critical care patients, and (f) implication of performance such as satisfaction, fatigue and burnout. The level of the evidence varied from systematic reviews (level I) to reports from expert committees (level VII). Of the 112 articles, there were ten (10) systematic reviews (8.9%) of relevant random controlled trials (RCT) that dealt with the change in allocation of health caregivers and providers. Seven (7) of the ten (10) had relevance to the evidence base for this

project. There were 31 articles (27.7%) that represented case controlled or cohort studies. The majority of the articles (63.4%) were single descriptive/qualitative studies (level VI) (Guyatt & Rennie, 2002).

The literature review was useful to comprehend the background evidence of the problem. However, the evidence reviewed and compiled during the search was not specific to the comprehensive examination of factors that ultimately would lead to a model to assess the NNP workload and caseload for this project.

Evaluation of the Evidence

Previous searches have shown that there is no evidence-based standardized method of determining the safe and appropriate caseload or workload for an NNP. This search was conducted to identify objective factors, or indicators, to guide the assessment of caseload/workload in a NICU.

The process of assigning patients to NNPs for a shift has been modeled from methods used by nurse caregivers, such as nurse-to-patient ratios predicated on tasks; and, methods used by the physician who oversees patients in a group (team or unit) by delegating functions/skills to care team members. The NNP, fellow, and medical resident are generally considered the roles with whom the physician delegates function, skills and tasks. The roles are distinctly different. The NNP is an autonomous licensed and credentialed provider. As trainees in different points of preparation in medicine, the medical fellows and residents are not.

The lack of a method, or objective evidence, to guide the development of a caseload/workload recommendation, is a compelling reason to better understand the practice and operations of the NNP to deliver holistic care to NICU patients and families. The variation in NICU environments, patient acuity, and NNP role makes the process of assessment at the level

of the microsystem (unit) a priority. Meaningful change will be sustainable if the stakeholders own and value the role at the unit level. Based on the review, the evidence that offers objective factors to assess NNP workload include: (a) role effectiveness, (b) experience, competence and skill acquisition level, (c) patient acuity/severity of illness, (d) workload of other providers; and (e) transparency and accountability.

Role Effectiveness

As a provider in the NICU workforce, the NNP should be able to demonstrate the effectiveness that the role contributes to the patients, families, interprofessional team, and the operation of the organization. Brooten et al. (2004) suggests the concept of "dose effect" as a means to study APRN effectiveness. There are three (3) components of the concept: (a) dose, expressed as the number of APRNs at the site, region or country, and the amount of APRN care measured in amounts of time or number of contacts; (b) APRN, described by education, expertise and experience; and, (c) host and host response, indicating the receptiveness of the organization, government, or patient/family to the APRN and the APRN practice. In subsequent work, Brooten et al. (2012) indicates that the level of severity-of-illness and complexity of care required by the patient is an important factor in describing the "dose" (Brooten, Youngblut, Kutcher, & Bobo, 2004; Brooten, Youngblut, Deosires, & Singhala, 2012).

Experience, Competence and Skill Acquisition

Continued learning, competency maintenance and monitoring of performance is critical to an effective outcome. Based on her interest in levels of competence, Benner adapted the Dreyfus Model of Skill Acquisition for clinical nurse professionals, to describe the translation of knowledge and technical skill to situations over time. The nurse applies the knowledge and skill within a context repeatedly to gain experience; and transitions from the rules of new knowledge

and skill to an interpretation based on the nuances of the situation. The accumulation of experience in a common context, such as the NICU, provides a strong base for effective decision-making and outcome. Benner (2001) describes this progression over time in five (5) stages, from least to most competent: (a) novice, (b) advanced beginner, (c) competent, (d) proficient, and expert (Pena, 2010; Dreyfus & Dreyfus, 1986; Benner, 2001) [SEE Appendix A].

The National Association of Neonatal Nurse Practitioners (NANNP) has published the *Competencies and Orientation Toolkit for Neonatal Nurse Practitioners*, 2nd edition, "to identify the core competencies inherent to the role of the practicing NNP, to provide a consistent process for evaluating NNP competency, and to promote continued professional development and participation in quality improvement efforts of NNPs as they advance from novice to expert during professional practice" (National Association of Neonatal Nurse Practitioners [NANNP], 2014, p. 2). The competency toolkit was developed utilizing four (4) models:

- Model for Multidimensional Competency that defines competency as a combination of cognitive, technical, behavioral and performance (Sweet & McDougall, 2008),
- Miller's Pyramid that describes the methods of competency evaluation as the cognitive functions of fact gathering and interpretation/application, and the behavioral functions of demonstration of learning and performance integrated into practice (Miller, 1990; NONPF, 2013),
- NONFP core competency domains (NANNP, 2014), and
- Benner's novice to expert model (Benner, 2001).

The tool kit includes education guides and evaluation tools to objectively assess the performance of the individual NNP based on the behaviors and skills applicable to each stage from novice to

expert. The monitoring of performance, continued learning, and competency maintenance are critical processes to sustain the functional capacity of the NNP as an autonomous care provider.

Patient Acuity/Severity-of-Illness

Neonatal providers, including APRNs have not standardized a tool or method to describe the complexity of patient care. However, there are many instruments that have been published since the 1980's to predict mortality by quantifying a measure of neonatal acuity/severity-of-illness, prediction of mortality, and providing an assessment of resource utilization, including patient/operational cost, and staff workload. By using a numeric scale to quantify specific criteria, the influence of variation in practice is limited. Some of the more utilized tools include: CRIB (Clinical Risk Index for Babies); SNAP (Score for Neonatal Acute Physiology); SNAP-PE (Score for Neonatal Acute Physiology with Perinatal Extension); NTISS (Neonatal Therapeutic Intervention Score System; and, NICHHD (National Institute of Child Health and Human Development network model).

Medlock et al. (2011) and Dorling et al. (2005) have published systematic reviews of neonatal severity scoring systems. The reviews were based on retrospective patient data collected in international NICUs to evaluate the predictability of patient mortality as the outcome variable for clinical quality performance. The multivariate instruments predicted mortality better than the common singular indicators of birth weight or gestational age. Because the variables were limited in most of the instruments, no one tool included the combination that could most reliably predict severity or mortality in all weight populations of neonates (Medlock et al., 2011; Dorling, Field, & Manktelow, 2005). The selection of a multivariate tool was an important aspect of preparation for this project.

The Neonatal Therapeutic Intervention Scoring System (NTISS) is a valid and reliable instrument developed in the early 1990's by Gray et al., (1992) as a modification of the Therapeutic Intervention Scoring System (TISS) used in adult and pediatric ICUs. A five (5) person panel of neonatology experts selected the therapeutic intensity and complexity indicators for the NTISS using nominal group techniques. Validity was determined using Cronbach's alpha for overall internal consistency and its relation to the markers of illness severity, including physician estimates of mortality risk, in-hospital mortality, nursing acuity, LOS, and total charges were compared using methods of statistical analysis (Gray et al., 1992).

Oygur et al. (2012) evaluated the accuracy of the NTISS as a predictor of severity-of-illness for the very low birthweight (VLBW) and extremely low birthweight (ELBW) babies. Area under the curve (AUC) was used to predict performance for the overall indicators of the instrument. The NTISS was found to be "a valid measure of therapeutic intensity and can be used as an indicator of neonatal illness severity and resource utilization" (Oygur, Ongun, & Saka, 2012, p. 498).

The strengths of the NTISS for use in the NICU include: (a) multivariate, inclusive of the patient's physiology, intervention, and hemodynamic status; (b) reflective of the dynamic nature of severity, (c) effective evaluation of patients across all weight categories, extreme low birth weight (ELBW) to term newborn weight through the NICU stay; (d) clear and logical, and (e) sustainable. The NTISS consists of 63 therapeutic interventions performed in the neonatal population to include: (a) respiratory, (b) cardiovascular, (c) drug therapy, (d) monitoring, (e) metabolic/nutrition, (f) transfusion, (g) procedural, and (h) vascular access. By assessing treatment received by neonates, the scale can accommodate variation in practice.

Though predictive, in such studies the acuity scores are most often utilized retrospectively. The measure of clinical quality performance, such as mortality, has traditionally been utilized by the medical discipline to compare overall practice outcomes from the unit to the global level. The data is further subdivided by birth weight category to evaluate volume compared with mortality outcome, and benchmarked geographically to determine practice outcomes by acuity. Generally speaking, the lower the weight, the more acute the patient. In addition to quality performance, the information about acuity can be used at the unit and organizational level, to define, distribute and budget operational resources. However, the frequent (daily) use of a scoring system with indicators to predict the patient's severity-of-illness can serve to forecast the resources needed to allocate staffing as necessary to meet the anticipated care needs of the patient.

A search using the keywords workload and Therapeutic Intervention Scoring System (TISS), identified the use of acuity tools to measure nurse workload in intensive care units in the United States, Germany, Brazil and the Netherlands. In 1996, Miranda, De Rijk and Schaufeli reported the findings of a prospective, multicenter study of 22 adult medical, surgical and general ICUs in the Netherlands to validate the TISS with 28 items compared with the full TISS instrument of 76 items. The TISS-28 was found to capture the significant elements of patient severity-of-illness and adequately replace the TISS-76 as a measure of nurse workload thus reducing the amount of time to complete the form. The statistical calculation of points for delivering care by the average nurse was equated to minutes per point, and was found to be the same for both tools (Miranda, De Rijk, & Schaufeli, 1996).

Padilha et al. (2008) and Muehler et al. (2010) have used the TISS-28 to assess nursing workload among intensive care patients in Brazil and Germany, respectively, to characterize

patient severity status and assess nursing workload to account for safe and quality care management (Padilha, Cardosa de Sousa, Queijo, Mendes, & Miranda, 2008; Padilha et al., 2007; Muehler et al., 2010). In a retrospective study of 125 patients of mixed gender and age over a 4-week period, Trope et al., (2014) reported that the Neonatal Therapeutic Intervention Scoring System (NTISS) instrument was modified as the TISS-C to assess the severity of patients in a pediatric intensive care unit in the United States. Though not able to be used for validity purposes due to changes, the TISS-C assessed the levels of patient acuity to indicate higher nurse workload. The findings suggest a significant increase in adverse events with high workloads (Trope, Vaz, Zinger, & Sagy, 2014).

Workload of Other Providers

Nurses comprise the largest resource of the workforce in most health care facilities. Evidence to describe and quantify workload among the nurse caregiver role is abundant. However, descriptive and/or quantitative evidence about the advanced practice nurse workload is limited. As health organizations transform to meet the increasing volume of insured and informed consumers, there is greater emphasis on understanding the role and operational performance by quantifying the value of the provider. Objective criteria generate a framework from which organizational leaders can monitor the effectiveness and efficiency of the workforce, and the data trend/patterns can indicate opportunities for improvement initiatives (Institute of Medicine, 2001).

There is an abundance of evidence to support the improvement of the learning environment and the well-being of medical residents (Levine, Adusumilli, & Landrigan, 2010; DeLaroche, Riggs, & Maisels, 2014; Cohen, Czeisler, & Landrigan, 2013; Sen et al., 2013; Typpo et al., 2012; Oshimura, Sperring, Bauer, & Rauch, 2012). Resident fatigue and overload

has been shown to negatively affect patient outcome and safety. Work shifts greater than 16 hours have been recommended to be reduced or eliminated. By doing so, resident education has not been found to be compromised, and the resident quality of life has been reported to improve. Subsequently, the recommendation for patient load has been reduced. Currently, ACGME (2011) recommends a maximum number of new admissions and transfers per day for first, second and third year residents; and maximum assignment loads in a 48 hour period per first, second and third year residents (ACGME, 2011, p. 12). For the NICU, ACGME offers a minimum of 4 patients per resident (ACGME, 2011, p. 65).

The evidence about sleep deficit and mental impairment is applicable to all disciplines. NANNP published a position statement recommending that "NNP shift length not exceed 24 hours, a period of protected sleep should follow 16 consecutive hours of working, and worked hours in a week should not exceed 60" (NANNP, 2012, p. 2). Ultimately, the professional is personally accountable to be mentally alert and physically able to perform in changing critical situations for the benefit of multiple neonatal patients. This concept should apply to workload and caseload, implying that there has to be flexibility in scheduling and provider resources to adjust up or down, as the personnel capability and workload warrants.

The caseload and workload of the nurse caregiver and the medical resident differ from the NNP. The job responsibilities of the nurse as a direct caregiver are to fulfill the plan-of-care designated for the specific patient by the health care team. The recommended staffing is based on nurse-patient ratios, and predicated on the level of diagnosis acuity defined by the American Academy of Pediatrics (AWHONN, 2010; AAP & ACOG, 2012; AAP COFN, 2012). The ratios and diagnostic levels of acuity do not account for the NNP responsibilities as a provider to multiple critical care patients. The recommendations of caseload for the medical resident do not

apply to the NNP. The resident is in an academic role that requires supervision from the NNP, fellow and physician attending.

Role Satisfaction of the NNP

A search of the evidence using the key words satisfaction and neonatal nurse practitioner, revealed few articles published within the decade that describes or evaluates the level of satisfaction of the NNP regarding role performance in the NICU. In a small sample of Midwest nurses working in the NICU, including NNPs, McDonald, Rubarth and Miers (2012) reported moderate overall satisfaction in their jobs and workplace. The influencing factors were caring for patients in a stressful situation, level of autonomy, and communication between nurses and NNPs. Timoney and Sansoucie (2012) described a positive correlation between job satisfaction and advanced educational preparation among 679 NNP respondents across the United States. Job satisfaction was slightly effected at the highest level of patient caseload, but was unrelated to shift length or structure. There was no identified relationship between practice size, years of experience, shift length or patient acuity (Timoney & Sansoucie, 2012). Profit et al., (2014) reported significant associations with job satisfaction, teamwork climate, safety climate, perceptions of hospital management and working conditions among nurses, nurse practitioners, respiratory care providers and physicians in 44 California NICUs when exploring links between burnout and adverse events. The evidence regarding NNP job satisfaction is limited. The studies are biased by small sample sizes, geographic areas/regions or inclusive of multiple roles/disciplines.

Transparency and Accountability

It is incumbent upon professionals and organizational leaders to: (a) assess the workforce, (b) identify the metrics, (c) continuously monitor the data, (d) evaluate, and (e)

change. Health care organizations are accountable to provide access to current therapeutics and support for clients. The organizations should be transparent about the quality, cost, and outcome metrics of the services provided. The collaborative practice team should have the resources and autonomy to provide safe, quality care to the consumer in a timely, efficient and cost effective manner (Institute of Medicine, 2001; Berwick, Nolan, & Whittington, 2008). As a member of the collaborative practice team, the NNP should be supported by the organizational system for the value contributed to the client, team and service.

Chapter Three: Methods

This project is the initial step in determining a workload for NNPs, in a single NICU, using objective factors to describe the effectiveness of the role. It is important to sustain a culture of safety by utilizing an evidence-based process to allocate care management and responsibility to the NNP without overloading the limited resources of the group.

Model for Change

To accomplish this project, Kotter's psychological framework was used to disseminate information and influence NNP participants to engage in the project. The goal was to influence NNPs to think, feel and behave differently, as opposed to the "way staffing has always been done". Working together to create a vision, or focus on objective measures, to define workload can empower the NNP and the neonatal collaborative team to comprehend, and potentially improve, the effectiveness of the provider team in the NICU (Kotter & Cohen, 2002) [SEE Appendix B].

Descriptive Measures

Descriptors applicable to this project were derived from the evidence. The objective measures include: (a) number of NNPs on a worked shift, (b) number of patients (contacts) in the NNP caseload on a worked shift, (c) acuity of the patients using the NTISS instrument, (d) additional responsibilities and activities performed during the worked shift, (e) education, experience, competence and skill acquisition of the NNP based on Benner's stages, (f) NNP response, or perception, to practice performance and patient outcome during the shift (host response/satisfaction), and (g) worked hours in a shift. The goal of the project is to assess the process of planning and assigning workload during the worked shift to the NNP as a provider of

complex care management in the NICU. The NNP will own and be empowered by the process if he/she can feel professionally safe, and satisfied in performance and patient outcome.

Collaboration to Address an Urgent Need

The author has been interacting on-site at the Level IV NICU with the NNPs and leaders in a collaborative effort to assess NNP workload, pending a forthcoming change in the staffing model. This project is based on an assessment of one unit. The resident duty hours in the NICU will be reduced by half with no resident coverage on the 12-hour night shift, and 1 to 2 residents on the 12-hour day shift to manage up to 10 NICU patients each. Currently, the NNPs manage approximately 55% (N=26-30) of the patient census, the residents manage the remaining patients under the supervision of a fellow. The change in model will take effect within months, leaving the NNPs to manage the majority of the patients in the unit, and increasing their current day shift patient caseload. A third NNP will be added to the night shift.

The mutual professional interest and a sense of urgency influenced the working relationship between this author and the NNP leaders. This project will develop a baseline of operational data from which to assess the NNP workload in the NICU. What is learned from the findings may help to incrementally formulate steps to improve the process of allocating budgeted positions of NNPs to the NICU to ensure a satisfactory and sustainable, safe, and equitable distribution of workload through the work shifts.

Process Planning Based on Organizational Culture

The NICU is a 59-bed capacity Level IV NICU with service to more than 16 maternity and newborn centers in a tri-state regional area. The unit provides on-site specialty and sub-specialty support in the management of high-risk deliveries through the maternal-fetal center, extracorporeal membrane oxygenation (ECMO), surgical repair of complex conditions including

heart; and provides a regional transport and back-transport service (AAP COFN, 2012). Over 700 high-risk babies are admitted annually. The NNP interacts as a collaborative member of each of the specialty and sub-specialty teams to manage the care and outcome of the high-risk infant and family.

The organizational culture exemplifies "cutting edge" research, technology, education, and practice in the provision of care to the fetus/baby, mother, and the family unit. High-risk babies are managed in the NICU through the course of their care, and followed after discharge, by an interprofessional team of sub-specialists until the time that the babies mainstream into the pediatric population. The strategic focus of the organization is continually improving health care to achieve best outcomes at a low cost.

The center for excellence is central to the culture of improvement, change and innovation. The leaders recognize themselves as early adopters of the Institute of Medicine (IOM) call for change and transformation. The value of continued learning, transparency, strategic thinking, and performance improvement methodology is evident through all levels of the organization (Institute of Medicine [IOM], 1999; IOM, 2001; IOM, 2008; IOM, 2011; IOM, 2013).

Faced with decreases in resource utilization and allocation, health organizations struggle to manage operational quality, safety and efficiency, and to be transparent to organization associates, external regulators, and consumers. Utilizing evidence, process, and objective criteria to assess, change and evaluate current practice in workforce utilization and workload distribution can posit opportunities to improve effectiveness and value among the roles. The evidence shows that the NNP is a key stakeholder in the NICU workforce, thus suggesting that the NNP workload needs to be assessed using objective factors, continuously monitored, evaluated, and

changes implemented over time to fully recognize and sustain the role. This project is the initial effort in this process.

The current process to assign a caseload of patients to the scheduled NNP is done by an NNP colleague from the previous shift. Typical caseloads are 6 patients on weekday day shift, 7-8 patients on weekend day shift, and 15 patients on weekday and weekend night shift. The continuity of patient care is a priority in making the assignment from shift-to-shift. The NNP's level of competence is not a consideration. Generally, it is a preference of the NNPs who work several consistent (linked) days, or days in one week, to manage the same caseload because they are familiar with the plan, and they can maintain the continuity-of-care for the patient and family. Another significant factor in assigning a patient caseload is the NNP who is precepting students or orientees.

NNPs rotate day and night shifts, and work scheduled weekends. Many of the NNPs work additional shifts in other city-wide level III NICUs, as the result of a management agreement between those units and the freestanding children's hospital neonatal service. It is possible that a NNP may work night shift in another unit, and day shift in the children's level IV NICU. The worked hours recorded for this project include only those performed in the freestanding children's hospital level IV NICU, and there was no survey question that inquired as to the number of continuous hours worked by the NNP, regardless of location.

Project Communication

The NNP leaders were engaged in the process to review the evidence for the project, dubbed the NNP Workload Project. They participated in the development of the collection tools for applicability, adjustment of the time for implementation, and clarification of the information presented to the NNP participants. The implementation design and process spanned several

months. The timeframe for the project was planned between the holidays and the spring/summer vacation when NNP staffing was stable.

Application was made to the university Institutional Review Board (IRB) for expedited review of the project. It was approved, and submitted through a reliance agreement to the IRB at the collaborative implementation site. Documentation of the IRB approval for this project is included in Appendix C.

Consistent with Kotter's psychological framework, the evidence, significance to practice, implementation plan, and timeframe for this project was shared with the NNPs and leaders in a regularly scheduled meeting, and discussed with openness and candor. The survey forms and tools for the project were reviewed, and the involvement of the NNP participant during the implementation was articulated. Privacy and confidentiality of the NNP and the patient recorded medical information was deliberated. The presentation was given 2-weeks prior to the implementation, to solicit thoughtful consideration, discussion, comment, and inquiry by the intended participants, the NNPs.

A key driver diagram was prepared for review with the NNP leaders and NNPs to envision the "big picture" perspective of the project. The improvement aim to assess workload was articulated, the objective measures of the project were the key drivers, and possible change interventions were proposed [SEE Appendix D]. The key driver diagram is a familiar process format used within the organization, so the NNPs were able to visualize the plan.

Project Implementation

At the initiation of the project, each NNP received a packet, including a copy of the verbal script of consent agreement, and contact information for the investigators and key personnel. The NNP received a unique project identifier (UPI) to use to code their identity when

completing the shift survey and the patient acuity instrument on each worked shift. In addition, each NNP completed a form noting their years of experience in the NICU as a registered nurse (RN) and a NNP, and the individual's self-reported level of NNP competence.

A total of 25 NNPs participated in the NNP Workload Project. The NNP participants represented 100% of the full-time and part-time workforce in the NICU, excluding those in orientation and on leave-of-absence. Input from the NNPs was encouraged through the project implementation to monitor their perspective, and to clarify concepts and points relevant to the evidence framework and the ongoing data collection process.

The project focused on the implementation of a process to collect objective data as a descriptive baseline of the NNP workload in the NICU during the worked shift. Tools were selected from the evidence, and surveys were designed with the intent to expeditiously capture the data from the NNPs about their performance during the worked shift.

The NNPs voluntarily completed an electronic shift survey and NTISS tool for each patient managed by the NNP for each worked shift over a consecutive 14-day period [SEE Appendix E]. The electronic NTISS tool was used to assess patient acuity. The NTISS is a 63-item intervention rating system based on a numeric acuity scale with points ranging, 1 to 4, for each item. The points were totaled and sorted from lowest to highest to indicate the gradient severity-of-illness. The highest score is the most acute (Gray et al., 1992) [SEE Appendix F]. Patients were coded to protect their identity using a unique project identifier (UPI).

The electronic daily shift survey and the NTISS was reviewed and discussed with the NNPs for input and familiarity prior to the implementation of the project. The author was available on-site to demonstrate the tools and respond to questions, comments, and concerns during the initial week of the implementation, and at scheduled times thereafter. A timely

response to questions was provided by phone, text, and email, when the author was not on-site. Key personnel involved with the project process were immediately available to support staff and answer questions.

A notebook containing the project proposal, survey instruments, tools, initial packet containing the verbal consent script and contact information, reference articles, the PowerPoint presentation about the project, and copies of the emails and communication conveyed to the NNPs and NNP leaders during the project. Additional information posted in the office area included reminders to complete the survey and NTISS at the end of the shift, paper tools to use for review, the definition of the NTISS items, schedule of the author's on-site time, and contact information.

The NNPs reported moderate ease in completing the survey and NTISS forms. The estimated time for completion was approximately 20 minutes for a workload of 8 patients, and up to 40 minutes for 15 patients. Familiarity with the forms expedited the process.

The data from the daily shift activity/workload, completed by each participant during the worked shift for the 14-day period, was submitted electronically, encrypted, and available to the author to review and collate. The objective data-points recorded and compiled include: (a) number of NNPs, (b) worked hours in a shift, (c) caseload number per NNP, (d) acuity of each patient in the caseload noted by the NTISS numeric score, (e) additional responsibilities and activities performed during the worked shift, (f) perception of NNP performance and patient outcome during the shift using a Likert scale, (g) concern for safety during the shift because staffing resources may not have met the need of patients, and (h) staffing adjustments made during the shift due to safety concern(s) communicated by the NNP. Descriptive statistics and correlations were used to analyze the resulting data.

Chapter Four: Findings

The findings determined from the data collected during the implementation of this project describe the characteristics of the NNP; NNP workload; acuity of the patients in the level IV NICU; and, perception of the NNP regarding safety, performance and patient outcome. The data has been collated and analyzed by individual factor and overall influence.

Characteristics of the NNP

The 25 NNP participants report a cumulative total of 313 years of experience as an RN in the NICU and 221.5 years as an NNP, for a combined total of 534.5 years of NICU experience. The average years of experience in the NICU as a NNP were 8.86. This data suggests that the NNP is acclimated to the context of the neonatal sub-specialty, which includes the environment, population, and care needs of the patients/families.

The level of competence reported by the majority of the NNPs was competent, proficient and expert. The years of NNP experience ranged from 1 to 25. Two NNPs described themselves as novice and advanced beginner with a year and less of experience. The data suggests that the more years of experience as an RN in the NICU, the higher the reported level of competence as a NNP, though there were exceptions. Some NNPs (23.5%, N=4) identified themselves as proficient and expert with 7 or less years of experience as an RN, and as a NNP in the NICU (Table 1).

The pattern exhibited by the years of NNP experience and self-reported level of competence reflect Benner's description of the levels of skill acquisition. The 24% (N=6) of the NNPs who reported themselves as competent averaged 10.7 years as a RN and 3.8 as a NNP; 28% as proficient (N=7) averaged 12.3 years as a RN and 6.9 as a NNP; and, 40% as expert (N=10) averaged 14.9 years as a RN and 14.9 as a NNP. The number of years as an NNP

seemed to influence the reported level of competence. There were exceptions that may have been motivated by the individual's level of confidence [SEE Appendix G].

It is interesting to note that the competence level self-reported by the NNPs is inconsistent with the suggested NNP years of experience that Benner has associated with each level (Benner, 2001). According to the reported years of NNP experience, there were more expert and advanced beginner NNPs and fewer proficient and competent NNPs. The likelihood that a nurse would identify as a novice was reduced by design, in that those NNPs on orientation were not included in the project [SEE Appendix G].

Workload of the NNP

The NNP reported an average of 12.69 worked hours during a shift. Often times, shift report from NNP-to-NNP would extend the time. The survey and NTISS tool was completed prior to the shift hand-off using an estimated end-time. NNPs are salaried at this organization so exact start and end shift hours were not available by other means. There was no appreciable difference between worked shift hours reported on days, nights or weekends. The range was 12.2 to 13.5 hours per shift.

The caseload number varied by weekday, night, and weekend day shifts. The scheduled week day shifts were generally staffed with 5 NNPs giving an average caseload of 5.51 patients; weekend day shift with 4 NNPs averaging 6.93 patients per caseload; and, night shift with 2 NNPs averaging 13.71 patients per caseload. The goal of this NICU on night shift is to disturb the baby less often with treatment/intervention(s) to allow quiet time/sleep. Consequently, there are fewer intentional changes to the plan of care so that interprofessional rounding is limited, generally, one time late evening. However, in a critical care unit, there are frequent unexpected patient events, such as admissions, status deterioration, crises, that influence the cultural intent

thus requiring the immediate utilization of undistracted qualified providers to support patient/family need(s).

Shift call-offs due to illness or an emergent situation further reduce the staffing, and increase caseload per provider for the shift. An on-call NNP is scheduled but resources or circumstance may preclude availability. If an NNP serving in another role during the shift, such as educator or manager, is accessible, she may take a caseload or assist with caseload management.

Based on the NANNP position statement, *NNP Workforce*, the recommended caseload per NNP is 6-10 allowing for the level of patient acuity and NNP competence (National Association of Neonatal Nurse Practitioners, 2013). The recent executive summary of the 2014 NNP Workforce Survey indicates that NNPs managing patients in a level IV NICU feel that it is unsafe to provide for an average caseload of 6 complex patients (Meier & Staebler, 2014). Average caseload number, patient acuity, and NNP level of competence are not formally planned for in developing a NNP schedule or shift assignment, other than balancing newer NNPs with experienced NNPs. Scheduling is completed weeks to months in advance, and subject to change. Availability is the primary consideration. Daily shift NNP caseload assignments are made by a peer on the previous shift.

This project is the first to use the NTISS acuity tool in a prospective manner to assess provider workload. It has been utilized retrospectively to measure the intensity of therapy as an indicator of acuity/severity-of-illness among NICU patients. Some pediatric and adult critical care units use a similar tool prospectively to assess patient acuity and resource utilization among nurse caregivers.

The shift workload of a NNP includes the expectation and performance of duties and responsibilities in addition to the management of a patient caseload. Though important, the activities may serve as distractors to the NNP on a busy shift when the NNP is juggling patient status changes, diagnostic tests and procedures to manage the condition of the patient, orientees and/or students, traveling with the patient, and integrating sub-specialist consultation recommendations. Some professional activities, if not completed during the shift, must be done on personal, unpaid time. This serves as an interruption to downtime, sleep, and family time, which contributes to building personal resilience—a much needed quality for the NNP who is expected to assume the caseload and workload of the decreasing presence of the residents in the NICU.

There was little variation in NNP satisfaction with performance or patient outcome at the end of the shift when compared to week day shift, night shift and weekend day shift. The NNPs reported a slight increase in satisfaction with performance and perception of patient outcome week 2 on all shifts compared to week 1. In general, there was a sense of less acuity, unexpected events, and parents in crisis among the NICU patient census which may account for level of satisfaction (Table 2).

The additional duties most frequently reported by the NNP included: (a) consulting with a sub-specialist; (b) covering the caseload of another NNP; (c) precepting students and orientees; (d) performing a QI activity (exclusive of this project); (e) management, coordination and scheduling; (f) traveling with a patient; (g) responding to and/or managing a crisis event to include codes, death, safety situations; and (h) supervising residents. There are many more duties, responsibilities and activities that the NNP identified as consuming their time and attention. Meier and Staebler (2014) suggest that the combination of managing the patients in

the caseload and additional responsibilities may "pose a challenge in the provision of safe patient care" (Meier & Staebler, 2014, p. 4). Little, if any, time was dedicated to the restorative care of the NNP, such as meals, breaks, or a walk out of the unit to get a beverage.

Acuity of the Patient

The numeric scoring of acuity/severity-of-illness using the NTISS tool yielded an average point total of 9.53 per patient for the first 7 days of the project, and 8.26 per patient for the next 7 days. The range of scores for the first 7 days of the project was 1 to 31, and in the next 7 days was 0 to 44; the higher the point-score, the more acute the patient. During the project, NNPs were intermittently asked about their intuitive sense of the overall patient acuity. Their response reflected the average of the NTISS scores—higher at the initiation of the project, then a dip, followed by an increase.

Gray et al. (1992) reported five (5) NTISS score ranges with an equal number of assessments in each category: (a) 0-9, (b) 10-19, (c) 20-29, (d) 30-39, and (d) 40 and above. Physician risk assessments that were compared to the NTISS scores used the descriptive categories: (a) low-risk except for low-probability catastrophic event, (b) mildly ill, still at small risk, (c) moderately ill, but excellent chance for survival, (d) extremely ill, but with good chance for survival, and (e) virtually certain death, now or delayed (Gray et al., 1992, p. 563-564).

In this project, the higher scores in the range (31 and 44) are indicative of the scores for extremely ill and imminent death categories reported by Gray et al. (1992). The average NTISS scores of 9.53 and 8.26 reported in this project suggest mildly ill, but still at risk for a catastrophic event. Given the nature of the patient diagnoses, therapies and condition during the 14-days of this project, this author finds the point-score ranges and the NTISS averages to be plausible.

The NTISS is comprised of 8 categories of indicators and 63-items for which a patient is assessed. The categories include: (1) monitoring, (2) respiratory, (3) metabolic/nutrition, (4) vascular access, (5) drug therapy, (6) procedure, (7) cardiovascular, and (8) transfusion. The categories appear in the rank order of the total scores for the items in the respective category. The same order was repeated in the second week.

The tool is developed to account for multiple configurations of items with associated point scores, but it is impossible to have a patient that would score points for every item. Patients that exhibited higher scores were babies at greater risk with severe hypoxemia, crisis events and whole body system deterioration, extracorporeal membrane oxygenation (ECMO), complex congenital diaphragmatic hernia (CDH), and a high-risk delivery of babies with twin-to-twin transfusion. Since the NTISS was developed in the early 1990's, item definitions were written specifically for this project that associate with current practice norms. However, some practice therapies have become less common, such as exchange transfusion and aminophylline administration, and others have been introduced. Examples of items not accounted for in the tool include: high flow oxygen, inhaled nitric oxide, pain control and sedation, and cerebral hypothermia.

There was weak correlation between NNP satisfaction with performance and the measures of NTISS patient acuity score ($r=0.24$, $p\leq0.001$ in weeks 1 and 2) and patient caseload number ($r=0.02$, $p\leq0.001$ in week 1, and $r= -0.13$, $p\leq0.001$ in week 2), and between NNP satisfaction with patient outcome and the measures of NTISS patient acuity score ($r=0.19$, $p\leq0.001$ in week 1, and $r=0.25$, $p\leq0.001$ in week 2) and patient caseload number ($r= -0.23$, $p\leq0.001$ in week 1, and $r\leq -0.17$, $p\leq0.001$ in week 2). Though the participation of the NNPs was strong, there were limited data to yield a significant relationship of the measures to

satisfaction. This will be re-evaluated when the data from the remaining 14-days are collated and statistically analyzed. Combining the totality of the responses will increase the number of caseload patients and the size of the data-set without separation of weekly groups (Table 3).

NNP Perception of Safety

The shift survey invited participants to respond to questions about safety. Was the scheduled staffing compromised or inadequate to meet the needs of patients? Was action taken to improve the staffing? Who provided the staffing support, i.e. physician, NNP, other? There were a total of 5 responses over the 14-day period, all on day shift. Adjustments were indicated in all instances. The staffing support was a NNP in 2 of the 3, and there was none indicated in one instance. The fifth response did not identify a safety concern but an adjustment was made without mention of what role fulfilled the need.

NNP Satisfaction

An essential inquiry of NNPs regarding workload is their satisfaction of performance and patient outcome. The NNP workforce has become the dependable qualified provider of care to patients in the NICU as physician/fellow/resident roles evolve with less clinical involvement and/or experience. Overall, the NNPs reported satisfaction (1-very satisfied to 5-very dissatisfied) with their performance during the shift and the outcome of the patients. The mean score for satisfaction with performance was 2.2 (N=45, S.D.=0.7) in week 1, and 1.67 (N=43, S.D.=0.8) in week 2. The mean score for satisfaction with patient outcome was 2.09 (N=45, S.D.=0.8) in week 1, and 1.65 (N=43, S.D.=0.8) in week 2. The NNPs manage patients that are low-risk and low probability of a catastrophic event, to patients with total system failure and the likelihood of death. The NTISS score average was 9.49 (N=53, S.D.=2.5) in week 1 and 8.36 (N=47, S.D.=2.3) in week 2. They manage patient caseloads of greater than recommended and

also perform additional responsibilities to guide and mentor professionals, and improve the practice. The NNP caseload average was 7.43 (N=53, S.D.=4.3) in week 1, and 7.60 (N=47, S.D.=3.8) in week 2. Even with a heavy load of responsibility and accountability, they report satisfaction in their performance during the shift. This would suggest that NNPs have coping mechanisms that can support the individual/group through stressful times and maintain a positive attitude (Table 4).

Discussion

The data discussed in this project represent a baseline described by a snapshot in time of a dynamic, complex, interactive process. The NNP is a primary provider of health care to a vulnerable critical care population, the high-risk baby and family. The descriptors of NNP, NNP workload, neonatal patient acuity, safety, and satisfaction are essential components of the "snapshot".

The analysis of the data indicates that the current workforce of NNPs manage caseloads that equal or exceed the level of 6 patients NNPs report to be unsafe in a level IV NICU (Meier & Staebler, 2014, p. 4). On the average (overall=9.81), the caseload of NNPs in this NICU, equal the 10 patients recommended by the professional association, NANNP, for expert practitioners. However, not all of the NNPs are experts (National Association of Neonatal Nurse Practitioners, 2013). Unlike the evidence cited in the *NNP Workforce* position statement, the data for the baseline description of this unit stipulates an objective measure of the acuity for each patient that the NNP manages in the caseload. There is no benchmark, so comparison should be made on internal monitoring over time.

When the measures of NNP satisfaction with performance, NNP satisfaction with patient outcome, NTISS patient score average, and the average of the patient caseload number were

statistically estimated by week, there were weak correlations among the measures. The analysis was done by 7-day periods which limited the size of the data set. This project represents 14-days of a 28-day implementation. At the conclusion of the 28 consecutive days, a statistical analysis will be done with one inclusive data-set representing twice the current population of patients. The larger size may provide significant correlations between and/or among the measures.

There was no statistical significance noted as a function of the individual levels of satisfaction response (Likert scale 1.0, very satisfied, to 5.0, very dissatisfied) and the average of NTISS scores and number of patients in a caseload during each week of the project. There was no correlation between NNP satisfaction of performance and patient outcome when compared with weekday shift, night shift and weekend day shift.

The NNPs reported the challenge of responding to the acute nature of the patient management; performing skills under pressure with precision and concentration; handling the constant interruption of inquiries; reflecting a calm confident appearance for distraught parents and families; and multitasking while thinking clearly and moving rapidly. Specific comments indicated that activity was high, the shifts were busy, parents were reacting with great stress to the declining health status of their baby, and time was extremely limited to manage and respond effectively to situations. This author observed that when interventions were required, the NNP reacted to the need with flexibility, thoughtfulness and innovation. NNPs demonstrate the ability to balance the intellectual stimulation with a clear focus, manage the chaos with patience and prioritization, and contain the emotion with grace. NNPs function in a high-stress job and rarely decline the challenge to do the right thing for the patient and family.

The analysis of the data indicates that the NNPs are satisfied with their performance during the worked shift and the outcome of the patients. There was no question that specifically

addressed satisfaction with the caseload number. This should be added to future surveys. There were a limited number of responses that stated concern for safety because the NNP scheduled staffing compromised or was inadequate to meet patient needs. Support by an NNP was made available during those instances so it can be assumed that the concern was resolved.

The model of staffing will change in the coming months. Current orientees will adjust the workforce by a small measure. The NNP will be expected to manage an estimated 15 or more additional patients in the census. The competence level of NNPs in a new context, even if experienced, may be less than needed to manage the combination of patient acuity and caseload in a busy, complex level IV NICU. Medical residents will be new (novice without any contextual experience) and require supervision and continuing education beyond the time that the fellow and attending is able to meet. The workload will increase.

Further steps in the process to assess NNP workforce, workload and caseload would be to replicate this project following the implementation of the new assignment model, perhaps in early autumn between summer vacations and holiday time-off. The data analysis will provide the difference between models, and a platform from which to develop incremental steps of improvement. The gaps between the actual caseload and the safe/recommended numbers can guide the incremental increase of NNPs to the workforce. Metrics, such as adverse/safety events and less-than-expected patient outcome, can serve as balancing measures through the monitoring of the incremental steps of change.

An interprofessional team of stakeholders is needed to pursue the continuing development, analysis, monitoring and recommendation of an ongoing improvement process. The team can include: NNPs, managers, neonatologists, quality improvement engineers, researchers, nurse practice doctorates, statisticians, and internet technicians.

A standardized method/tool to assess patient acuity in the NICU should be used in all NICUs. Productivity measures are of little value unless there is an objective indicator of the acuity from which to gauge differences. Time and task tools provide quantitative units that can be equated to activity, expenditure or revenue. However, such quantitative units do not indicate the complexity of the situation from which time and task unit is applied, and the emergent nature of response to achieve an outcome.

The NICU has been using a patient classification tool (task oriented) to monitor NNP activity and patient care. A step in the process to better understand NNP workforce, workload and caseload is to compare the results of the patient classification model to the results of this NNP workload project. This will be an interesting learning experience for the NNPs, NNP leaders and the author.

NNP satisfaction associated with workload and caseload may be a better indicator of overall workforce satisfaction than general employee surveys. Health providers value the commitment and intellectual effort that they give to their professional endeavors through their effectiveness, as evidenced by the outcome/response of the patient/family for which they provide management and care.

Conclusions

The NNP workload project will be an ongoing process, from this baseline and the findings/conclusions that may evolve from the comparison of this project with the ongoing patient classification initiative. The NNPs, NNP leaders and this author are invested in developing a sustainable process by which to objectively describe, measure, monitor and improve the workforce, workload and caseload to qualify and quantify the value of the NNP as a provider in the NICU.

Chapter Five: Summary

The purpose of the NNP workload project is to describe the assignment patterns of the NNP in a level IV NICU by utilizing objective measures to define the workload during a worked shift. The measures include: (a) number of NNPs assigned to the shift, (b) caseload, (c) patient acuity, (d) experience and competence of the NNP, (e) perception of safety, and (f) level of satisfaction of the NNP in relation to assignment factors.

The scheduling and shift assignment of NNPs is traditionally developed by the executive leadership of the organization using historical operational budget data. Patterns of the past do not always meet the needs of the present and future. Roles evolve over time to keep pace with the science and practice standards, but operations tend to lag with convention instead of advancing with change.

Physician, medical fellow and resident, and NNP roles have evolved. In current practice, the NNP has become the direct provider of the patient in the clinical setting, the physician has become an educator and conductor of clinical sub-specialty decision-making, and the fellows and residents are pursuing clinical training at the point-of-service as opposed to the academic setting.

The factors used in this project were derived from Brooten's explanation of dose effect to describe the effectiveness of the advanced practice nurse (Brooten et al., 2012; Brooten et al., 2004). The NNP is a master's prepared nurse with sub-specialty education in the area of neonatology, certified and credentialed to practice as a competent provider of neonatal health care. Benner's levels of skill acquisition used to guide the development of knowledge and skill defines the competence of the NNP, and with further study may be useful as a guide for an appropriate caseload number and level of patient acuity (Benner, 2001; NANNP, 2014).

The NTISS acuity tool is a reliable and valid instrument from which to objectively describe the physiologic status of the patient, and in an electronic form was relatively easy to use. Perhaps, limiting the responses to a "yes" at the applicable item, as opposed to a "yes" or "no" at each item would increase the efficiency of completing the form. It might reduce the likelihood of error. The NTISS needs to be updated to current practice therapies. With further study, it may be as effective used once every 24 hours as opposed to every 12 hours, as was the case for this project.

The satisfaction of the NNP regarding performance and patient outcome acknowledges the perception of the NNP relative to the management that she/he is accountable to perform for the patient and family. The correlation of NNP satisfaction with caseload number and acuity may be an effective measure of increased workload and an indicator of potential safety concerns.

Limitations

The limitations of this project included the small number of NNP participants and the small size of the patient population when analyzed by week as opposed to combining the data. The data represents 14-days of a 28-day implementation. This is baseline data that cannot be generalized or compared. There is further analysis, interpretation and study to be done.

The steps and tools of the NNP workload project take time and commitment from many disciplines to develop and manage. If the NNPs, or neonatal department, is using a patient acuity scale, it may be more feasible to add a shift survey tool and implement the process expeditiously. Electronic instruments make it easier to attract NNP participants to submit the data, but may need to be built, or adapted. It is recommended that an Internet technologist, computer programmer, and/or informatics specialist guide the data input, throughput, output and storage processes. Consequently, this is not a short-term, or rapid-cycle, improvement initiative.

Planning long term, and monitoring data for internal comparison will provide a pattern of resource utilization that can lead to strategic improvement aims.

Implications for Nursing Practice

The primary implication for nursing practice that the NNP workload project offers is an opportunity to monitor the scope of function performed by the NNP as a provider within a complex critical care sub-specialty, and assess the NNP's perception of his/her performance and patient outcome during the worked shift. Comprehending the scope of practice from the perspective of the workforce provider at the time of performance is a critical component to building a resilient workforce to serve a vulnerable population amid an interprofessional health care team. Using informatics to gather, monitor and evaluate an ongoing process can lead to improvements that can be translated to metrics of value, and lead to the sustainment of the workforce in an evolving system.

References

Accreditation Council for Graduate Medical Education. (2011). *Graduate Medical Education Common Duty Hour Requirements*. Retrieved from http://acgme.org/acgmeweb/tabid/271/GraduateMedicalEducation/DutyHours.aspx

Allred, C. A., Arford, P. H., Bellig, L. L., & Bissinger, R. L. (1997). A cost-effectiveness analysis of neonatal nurse practitioners. *Nursing Economics, 15*(2), 92. Retrieved from http://go.galegroup.com.proxy.lib.ohio-state.edu/ps/retrieve.do?sgHitCountType=None&...

American Academy of Pediatrics Committee on Fetus and Newborn. (2012). Levels of neonatal care. *Pediatrics, 130*(3), 587-597.

American Academy of Pediatrics & the American College of Obstetricians and Gynecologists. (2012). Guidelines for perinatal care. In (7th ed.). Elk Grove Village, IL: Author.

American Association of Colleges of Nursing. (2014). *Expanded roles for the advanced practice nurse*. Retrieved from http://www.aacn.nche.edu/media-relations/fact-sheets/apn-roles

American Association of Nurse Practitioners. (2013). *Scope of practice for nurse practitioners*. Retrieved from www.aanp.org

American Nurses Credentialing Center website. (n.d.). http://www.nursecredentialing.org/Magnet

Association of Women's Health, Obstetrics & Neonatal Nurses. (2010). *Guidelines for professional registered nurse staffing for perinatal units*. Washington, DC: Author.

Beal, J. A., Richardson, D. K., Denbrinski, S., Hipp, K. O., McCourt, M., Szlachetka, D., & Vaccaro, D. M. (1999). Responsibilities, roles and staffing patterns of nurse practitioners in the neonatal intensive care unit. *The American Journal of Maternal-Child Nursing,*

24(4), 168-175. Retrieved from http://ovidsp.tx.ovid.com.proxy.lib.ohio-state.edu/sp-3.13.0b/vidweb.cgi

Bellini, S. (2013). State of the state: NNP program update 2013. *Advances in Neonatal Care*, *13*(5), 346-348. http://dx.doi.org/10.1097/ANC.ob013e3182a35a7e

Benner, P. (2001). *From novice to expert: Excellence and power in clinical nursing practice.* (Commemorative edition ed.). Upper Saddle River, NJ: Prentice Hall Health.

Berwick, D. M., Nolan, T. W., & Whittington, J. (2008). The triple aim: Care, health, and cost. *Health Affairs, 27*(3), 759-769. http://dx.doi.org/10.1377/hlthaff.27.3.759

Brooten, D., Youngblut, J. M., Deosires, W., & Singhala, K. (2012). Global considerations in measuring effectiveness of advanced practice nurses. *International Journal of Nursing Studies, 49,* 906-912. http://dx.doi.org/10/1016/j.ijnurstu.2011.10.022

Brooten, D., Youngblut, J. M., Kutcher, J., & Bobo, C. (2004). Quality and the nursing workforce: APNs, patient outcomes and health care costs. *Nursing Outlook, 52,* 45-52. http://dx.doi.org/10.1016/j.outlook.2003.10.009

Brown, S. A., & Grimes, D. E. (1995). A meta-analysis of nurse practitioners and nurse midwives in primary care. *Nursing Research, 44*(6), 332-339.

Cohen, I. G., Czeisler, C. A., & Landrigan, C. P. (2013). Making residency work hour rules work. *Journal of Law, Medicine & Ethics,* 310-314.

Cusson, R. M., Buus-Frank, M. E., Flannagan, V. A., Miller, S., Zukowsky, K., & Rasmussen, L. (2008). A survey of the current neonatal nurse practitioner workforce. *Journal of Perinatology, 28,* 830-836. http://dx.doi.org/10.1038/jp.2008.106

DeLaroche, A., Riggs, T., & Maisels, M. J. (2014). Impact of the new 16-hour duty period on pediatric interns' neonatal education. *Clinical Pediatrics, 53*(1), 51-59. http://dx.doi.org/10.1177/0009922813500847

DiCenso, A. (1998). The neonatal nurse practitioner. *Pediatrics, 10,* 151-155. http://dx.doi.org/1040-8703

Dorling, J. S., Field, D. J., & Manktelow, B. (2005). Neonatal disease severity scoring system. *Arch Dis Child Fetal Neonatal Ed, 90,* 11-16. http://dx.doi.org/10.1136/adc.2003.048488

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over machine: The power of human intuition and expertise in the age of the computer*. Oxford: Basil Blackwell.

Frank, J. E., Mullaney, D. M., Darnall, R. A., & Stashwick, C. A. (2000). Teaching residents in the neonatal intensive care unit: A non-traditional approach. *Journal of Perinatology, 2,* 111-113. Retrieved from

Freed, G. L., Dunham, K. M., Moran, L. M., & Spera, L. (2012). Resident work hour changes in children's hospitals: impact on staffing patterns and workforce needs. *Pediatrics, 130*(4), 700-704. http://dx.doi.org/10.1542/peds.2012-1131

Freed, G. L., Dunham, K. M., Switalski, K. E., Jones, Jr, M. D., & McGuinness, G. A. (2009). Pediatric fellows: Perspectives on training and future scope of practice. *Pediatrics, 123,* S31-S37. http://dx.doi.org/10.1542/peds.2008-15781

Fry, M. (2011). Literature review of the impact of nurse practitioners in critical care services. *British Association of Critical Care Nurses, 16*(2), 58-66.

Garland, A., & Gershengorn, H. B. (2013). Staffing in the ICUs: Physicians and alternative staffing models. *Chest, 143*(1), 214-221. http://dx.doi.org/10.1378/chest.12-1531

Gray, J. E., Richardson, D. K., McCormick, M. C., Workman-Daniels, K., & Goldmann, D. A. (1992). Neonatal therapeutic intervention scoring system: a therapy-based severity-of-illness index. *Pediatrics*, *90*(4), 561-567.

Guyatt, G., & Rennie, D. (2002). . In *Users' guides to the medical literature*. Chicago, IL: American Medical Association.

Hall, D., & Wilkinson, A. R. (2005). Quality of care by neonatal nurse practitioners: A review of the Ashington experiment. *Arch Dis Child Fetal Neonatal Ed*, *90*, 195-200. http://dx.doi.org/10.1136/adc.2004.055996

Honeyfield, M. E. (2009). Neonatal nurse practitioners: Past. present, and future. *Advances in Neonatal Care*, *9*(3), 125-128. Retrieved from www.advancesinneonatalcare.org

Institute of Medicine. (1999). *To error is human: Building a safer health system*. Retrieved from http://iom.com/Reports/1999/To-Error-is-Human-Building-a-Safer-Health-System.aspx

Institute of Medicine. (2001). *Crossing the chasm: A new health system for the 21st century*. Retrieved from http://iom.edu/Reports/2001/Crossing-the-Quality-Chasm-A-New-Health-System-for-the-21st-Century.aspx

Institute of Medicine. (2008). *The future of nursing: leading change, advancing health*. Retrieved from www.iom.edu/nursing

Institute of Medicine. (2010). *The future of nursing: focus on scope of practice* [Report brief]. Retrieved from www.iom.edu/nursing

Institute of Medicine. (2011). *Health IT and patient safety: Building safer system for better care*. Retrieved from http://iom.edu/~/media/FilesReport%20Files/2011/Health-IT/HealthITandPatientSafetyreportbrieffinal_new.pdf

Institute of Medicine. (2013). *Establishing Transdisciplinary Professionalism for Improving Health Outcomes - Workshop Summary*. Retrieved from http://iom.edu/Reports/2013/Establish-Transdisciplinary-Professionalism-for-Improving-Health-Outcomes.

Jackson, D. J., Lang, J. M., Swartz, W. H., Ganiats, T. G., Fullerton, J., Ecker, J., & Nguyen, U. (2003). Outcomes, safety, and resource utilization in a collaborative care birth center program compared with traditional physician-based perinatal care. *American Journal of Public Health, 93*(6), 999-1006.

Jaeger, C., Chair, Timoney, P., Greene, C., Keels, E., Mullaney, D., Philbrook, J., & Wallman, C. (2012, October). *NANNP summit: The leader within the APRN*. Paper presented at the National Association of Neonatal Nurse Practitioners, Palm Springs, CA. Retrieved from http://www.nann.org

Juretschke, L. J. (2003). New standards for resident duty hours and the potential impact on the neonatal nurse practitioner role. *Advances in Neonatal Care, 3*(4), 159-161. http://dx.doi.org/10.1016/S1536-0903(03)00144-9

Karlowicz, M. G., & McMurray, J. L. (2000). Comparison of neonatal nurse practitioners' and pediatric residents' care of extremely low-birth-weight infants. *Archive of Pediatric and Adolescent Medicine, 154,* 1123-1126. Retrieved from http://archpedi.jamanetwork.com

Kotter, J. P., & Cohen, D. S. (2002). *The heart of change*. Boston, MA: Harvard Business Review Press.

Laurant, M., Reeves, D., Hermens, R., Braspenning, J., Grol, R., & Sibbald, B. (2005). Substitution of doctors by nurses in primary care. *Cochrane Database of Systematic*

Reviews, *2*. Abstract retrieved from http://onlinelibrary.wiley.com (Accession No. CD001271)

Levine, A. C., Adusumilli, J., & Landrigan, C. P. (2010). Effects of reducing or eliminating resident work shifts over 16 hours: A systematic review. *SLEEP*, *33*(8), 1043-1053.

McDonald, K., Rubarth, L. B., & Miers, L. J. (20*12*). Job satisfaction of neonatal intensive care nurses. *Advances in Neonatal Care*, 12(4). http://dx.doi.org/Retrieved from

Medlock, S., Ravelli, A. C., Tamminga, P., Mol, B. W., & Abu-Hanna, A. (2011). Prediction of mortality in very premature infants: A systematic review of prediction models. *PLoS ONE*, *6*(9), 1-9. http://dx.doi.org/10.1371/journal.pone.0023441

Meier, S., & Staebler, S. (2014). *2014 Neonatal nurse practitioner workforce survey*. Retrieved from National Association of Neonatal Nurses website: www.nann.org

Miller, G. E. (1990). The assessment of clinical skills/competence/performance [Supplement]. *Academic Medicine*, *65*(9), S63-S67.

Miranda, D. R., De Rijk, A., & Schaufeli, W. (1996). Simplified therapeutic intervention scoring system: The TISS-28 items--Results from a multicenter study. *Critical Care Medicine*, *24*(1), 64-73.

Mitchell-DiCenso, A., Guyatt, G., Marrin, M., Goeree, R., Willan, A., Southwell, D., ... Baumann, A. (1996). A controlled trial of nurse practitioners in neonatal intensive care. *Pediatrics*, *98*(6 Pt 1), 1143-1148. Retrieved from http://www-ncbi-nlm-nih-gov.proxy.lib.ohio-state.edu/pubmed/8951267

Muehler, N., Oishi, J., Specht, M., Rissner, F., Reinhart, K., & Sakr, Y. (2010). Serial measurement of therapeutic intervention scoring system-28 (TISS-28) in a surgical

intensive care unit. *Journal of Critical Care*, *25*, 620-627. http://dx.doi.org/10.1016/j.jcrc.2010.03.008

Mundinger, M. O., Kane, R. L., Lenz, E. R., Totten, A. M., Tsai, W., Cleary, P. D., ... Shelanski, M. L. (2000). Primary care outcomes in patients treated by nurse practitioners or physicians: A randomized trial. *JAMA*, *283*(1), 59-68. Retrieved from http://jama.jamanetwork.com

National Association of Neonatal Nurse Practitioners. (2012). *The impact of advanced practice nurses' shift length and fatigue on patient safety*. Glenview, IL: National Association of Neonatal Nurses.

National Association of Neonatal Nurse Practitioners. (2013). *Neonatal Nurse Practitioner Workforce* (Position Statement #3058). Retrieved from National Association of Neonatal Nurses: www.nann.org/uploads/NNP_Workforce_Position_Statement_FINAL.pdf

National Association of Neonatal Nurse Practitioners. (2014). *Competencies and orientation toolkit for neonatal nurse practitioners, 2nd ed*. Chicago, IL: National Association of Neonatal Nurses.

National Association of Neonatal Nurse Practitioners. (2014). *Education standards and curriculum guidelines for neonatal nurse practitioner programs*. Chicago, IL: Author.

National Council of State Boards of Nursing. (2008). *Consensus model for APRN regulation: licensure, accreditation, certification & education*. Retrieved from http://www.ncsbn.org/Consensus_Model_for_APRN_Regulation_July_2008.pdf

National Organization of Nurse Practitioner Faculties. (2013). *Population-focused nurse practitioner competencies*. Retrieved from

http://c.ymcdn.com/sites/www.nonpf.org/resource/resmgr/competencies/populationfocusnpcomps2013.pdf

Newhouse, R. P., Stanik-Hutt, J., White, K. M., Johantgen, M., Bass, E. B., Zangaro, G., ... Weiner, J. P. (2011). Advanced practice nurse outcomes 1990-2008: A systematic review. *Nursing Economics*, *29*(5), 1-21.

Nightingale, F. (1946). *Notes on nursing: What it is, and what it is not.* Edward Stern & Company: Philadelphia, PA.

Oshimura, J., Sperring, J., Bauer, B. D., & Rauch, D. A. (2012). Inpatient staffing within pediatric residency programs: Work hour restrictions and the evolving role of the pediatric hospitalist. *Journal of Hospital Medicine, 7*(4), 299-303. http://dx.doi.org/10.1002/jhm.952

Oygur, N., Ongun, H., & Saka, O. (2012). Risk prediction using a neonatal therapeutic intervention scoring system in VLBW and ELBW preterm infants. *Pediatrics International*, *54*, 496-500. http://dx.doi.org/10.111/j.1442-200X.2012.03576.x

Padilha, K. G., Cardosa Sousa, R. M., Kimura, M., Kazue Miyadahira, A. M., Monteiro da Cruz, D. A., Vattimo, M., ... Carlessi Mayor, E. R. (2007). Nursing workload in intensive care units: A study using the therapeutic intervention scoring system-28 (TISS-28). *Intensive and Critical Care Nursing*, *23*, 162-169. http://dx.doi.org/10.1016/j.iccn.2006.07.004

Padilha, K. G., Cardosa de Sousa, R. M., Queijo, A. F., Mendes, A. M., & Miranda, D. R. (2008). Nursing activities score in the intensive care unit: Analysis of the related factors. *Intensive and Critical Care Nursing*, *24*, 197-204. http://dx.doi.org/10.1016/j.iccn.2007.09.004

Pena, A. (2010). The dreyfus model of clinical problem-solving skills acquisition: A critical perspective. *Medical Education Online, 15*. http://dx.doi.org/10.3402/meo.v15i0.4846

Profit, J., Sharek, P. J., Amspoker, A. B., Kowalkowski, M. A., Nisbet, C. C., Thomas, E. J., ... Sexton, J. B. (2014). Burnout in the NICU setting and its relation to safety culture. *BMJ Quality & Safety*, *23*, 806-813. http://dx.doi.org/10.1136/bmjqs-2014-002831

Sen, S., Kranzler, H. R., Didwania, A. K., Schwartz, A. C., Amarnath, S., Kolars, J. C., ... Guille, C. (2013, Apr 22, 2013). Effects of the 2011 duty hour reforms on interns and their patients: A prospective longitudinal cohort study. *JAMA Intern Med*, *173*(8), 657-662. http://dx.doi.org/10.1001/jamainternmed.2013.351

Smith, S. L., & Hall, M. A. (2011). Advanced neonatal nurse practitioners in the workforce: A review of the evidence to date. *Arch Dis Child Fetal Neonatal Ed, 96*, 151-155. http://dx.doi.org/10.1136/adc.2009.168435

Starmer, A. J., Duby, J. C., Slaw, K. M., Edwards, A., Leslie, L. K., & Members of the Vision of Pediatrics 2020Task Force (2010). Pediatrics in the year 2020 and beyond: Preparing for plausible futures. *Pediatrics, 126*(5), 971-981. http://dx.doi.org/10.1542/peds.2010-1903

Sweet, R. M., & McDougall, E. M. (2008). Simulation and computer animated devices: The new minimally invasive skills training paradigm. *Urology Clinics of North America, 35*(3), 519-531.

The Joint Commission. (2011). *Standards BoosterPak for focused professional practice evaluation/ongoing professional practice evaluation (FPPE/OPPE)*. Retrieved from http://www.vanderbilt.edu/documents/CAPNAH/files/Forms/Competency%20Evaluation%20Forms/TJC%20Booster%20Pack%20FPPE-OPPE.pdf

Timoney, P., & Sansoucie, D. (2012). Neonatal nurse practitioner workforce survey executive summary. *Advances in Neonatal Care, 12*(3), 176-178. http://dx.doi.org/10.1097/ANC.Ob013e3182598d15

Timoney, P., & Sansoucie, D. (2012). *Report of the 2011 Neonatal Nurse Practitioner Workforce Survey*. Glenview, IL: National Association of Neonatal Nurses.

Trope, R., Vaz, S., Zinger, M., & Sagy, M. (2014). An updated therapeutic intervention scoring system for critically ill children enables nursing workload assessment with insight into potential untoward events. *Journal of Intensive Care Medicine*. http://dx.doi.org/10.1177/0885066613519938

Typpo, K. V., Tcharmtchi, M. H., Thomas, E. J., Kelly, P. A., Castillo, L. D., & Singh, H. (2012). Impact of resident duty hour limits on safety in the ICU: A national survey of pediatric and neonatal intensivists. *Pediatric Critical Care Medicine*, *13*(5), 578-582. http://dx.doi.org/10.1097/PCC.0b013e318241785c

Woods, L. (2006). Evaluating the clinical effectiveness of neonatal nurse practitioners: An exploratory study. *Journal of Clinical Nursing*, *15*, 35-44. http://dx.doi.org/10.1111/j.1365-2702.2005.01246.x

Zaccagnini, M. E., & Edinger, G. M. (2011). Traditional advanced practice roles for the DNP. In M. E. Zaccagnini, & K. W. White (Eds.), *The doctor of nursing practice essentials* (pp. 349-400). Sudbury, Massachusetts: Jones & Bartlett Publishers.

Table 1 Summary of NNP Demographics

Summary of NNP Demographics					
Level of Competence (Self-reported)	**Number**	**Level of Competence using Benner Model**	**Years of experience: NICU RN**	**Years of Experience: NICU NNP**	**Years of Experience: Total**
Expert	N=10 (40%)	N=15 (60%)	149 (Av=14.9)	149 (Av=14.9)	298 (Av=29.8)
Proficient	N=7 (28%)	N=3 (12%)	86 (Av=12.3)	48 (Av=6.9)	134 (Av=19.1)
Competent	N=6 (24%)	N=2 (8%)	64 (Av=10.7)	23 (Av=3.8)	87 (Av=14.5)
Advanced Beginner	N=1 (4%)	N=5 (20%)	11	1	12
Novice	N=1 (4%)	N=0	3	0.5	3.5
TOTAL	N=25		313 (Av=12.5)	221.5 (Av=8.86)	534.5 (Av=21.4)

Table 2: NNP Satisfaction as a Function of Shift

NNP Satisfaction as a Function of Shift								
		NNP Satisfaction-Performance				NNP Satisfaction-Pt Outcome		
Week 1	Shift	N	Mean	STD		N	Mean	STD
	Day	24	2.25	0.7		24	2.13	0.8
	Night	13	2.00	0.8		13	1.85	0.9
	Weekend Day	8	2.38	0.5		8	2.38	0.5
	Total	45				45		
		NNP Satisfaction - Performance				NNP Satisfaction-Pt Outcome		
Week 2	Shift	N	Mean	STD		N	Mean	STD
	Day	22	1.86	0.8		22	1.86	0.8
	Night	13	1.62	0.9		13	1.46	0.7
	Weekend Day	8	1.25	0.5		8	1.38	0.7
	Total	43				43		

Table 3: Correlation Estimates for NNP Satisfaction, NTISS Scores, and Patient Outcomes

Correlation Estimates for NNP Satisfaction, NTISS Scores and Patient Caseload Number				
Week 1				
Measure	NNP Satisfaction w/Performance	NNP Satisfaction w/Patient Outcome	NTISS Scores - Average	Patient Caseload Number
NNP Satisfaction w/Performance	1			
NNP Satisfaction w/Patient Outcome	0.63***	1		
NTISS Scores - Average	0.24	0.19	1	
Patient Caseload Number	0.02	-0.23	-0.26	1
Key: ~p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001				

Correlation Estimates for NNP Satisfaction, NTISS Scores and Patient Caseload Number				
Week 2				
Measure	NNP Satisfaction w/Performance	NNP Satisfaction w/Patient Outcome	NTISS Scores - Average	Patient Caseload Number
NNP Satisfaction w/Performance	1			
NNP Satisfaction w/Patient Outcome	0.09***	1		
NTISS Scores - Average	0.24	0.25	1	
Patient Caseload Number	-0.13	-0.17	0.02	1
Key: ~p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001				

Table 4: NNP Satisfaction

NNP Satisfaction Compared with NTISS Average and Patient Caseload Number

	Week							
	1				2			
	N	Median	Mean	STD	N	Median	Mean	STD
NNP Satisfaction w/Performance	45	2	2.20	0.7	43	2	1.67	0.8
NNP Satisfaction w/Patient Outcome	45	2	2.09	0.8	43	1	1.65	0.8
NTISS Score Average	53	9.38	9.49	2.5	47	8	8.36	2.3
Patient Caseload Number	53	6	7.43	4.3	47	6	7.60	3.8

		NNP Satisfaction w/Performance						**NNP Satisfaction w/Pt Outcome**					
	Satisfaction Scale	Av NTISS			Av Caseload			Av NTISS			Av Caseload		
		N	Mean	STD	N	Mean	STD	N	Mean	STD	N	Mean	STD
Week 1	1 - Very Satisfied	2	10.15	0.5	2	5.5	0.7	6	8.63	1.1	6	8.67	4.5
	2 - Satisfied	21	8.33	1.9	21	7.52	3.5	20	8.73	2.1	20	7.20	3.2
	3 - Neutral	11	9.74	2.2	11	7.36	3.4	7	9.61	2.6	7	7.29	2.6
	4 - Dissatisfied	1	11.00	0	1	6	0	2	9.83	1.6	2	4.50	2.1
	5 - Very Dissatisfied	0	0	0	0	0	0	0	0	0	0	0	0
	Total	35			35			35			35		
		NNP Satisfaction w/Performance						**NNP Satisfaction w/Pt Outcome**					
	Satisfaction Scale	Av NTISS			Av Caseload			Av NTISS			Av Caseload		
		N	Mean	STD	N	Mean	STD	N	Mean	STD	N	Mean	STD
Week 2	1 - Very Satisfied	17	8.24	1.1	17	6.94	3.5	17	8.32	1.2	17	7.12	3.3
	2 - Satisfied	12	9.43	3.4	12	6.42	3	11	9.14	3.5	11	6.18	3.3
	3 - Neutral	3	9.54	2.5	3	5.65	0.6	4	9.99	2.3	4	5.75	0.5
	4 - Dissatisfied	0	0	0	0	0	0	0	0	0	0	0	0
	5 - Very Dissatisfied	0	0	0	0	0	0	0	0	0	0	0	0
	Total	32			32			32			32		

Appendix A: Benner Novice-to-Expert Model

Figure A1. Benner's Novice-to-Expert Model. From "Novice to expert: Excellence and power in clinical nursing practice. (Commemorative edition) by P. Benner, 2001, Upper Saddle River, NJ: Prentice Hall Health. Illustration retrieved from http://www.bing.com/images/search/?q=Patricia+Benner+Novice+to+Expert&FORM=BRQONH on 12-11-14.

Expert - stage in which the Neonatal Nurse Practitioner (NNP) tests and refines theoretical and practical knowledge in actual situations. The expert has a deep background understanding of clinical situations based upon many past paradigm cases and possesses a hybrid of theoretical and practical knowledge. The NNP demonstrates fluent completion of tasks with high efficiency and expertise.

Proficient - stage at which the NNP perceives situations as wholes rather than in terms of their aspects is able to recognize which aspects of a situation are most salient, and has an intuitive grasp of the situation based upon a deep background understanding. When decisions are made by the NP during this stage, a firm judgment can be formed because of the increased expertise.

Competent - stage typified by the NNPs considerable degree of conscious, deliberate planning. The plan dictates which attributes and aspects of the current and contemplated future situation are to be considered most important and which can be ignored. This stage is evidenced by an increased level of efficiency; a framework has begun to be developed.

Advanced Beginner - stage in which the NNP demonstrates marginally acceptable performance. The advanced beginner has coped with enough real situations that she/he is able to note recurring meaningful situations or have them pointed out by a mentor. Newly graduated NNPs may be in this stage in the case of commonly occurring situations. During this stage, a foundation is created to guide behavior.

Novice - stage in which the NNP has no background understanding of/or experience in the clinical situation, so that context-free rules and attributes are required for safe entry and performance in the situation. This is the entry for newly graduated NNPs. The NNP is educated on common standards in which to accomplish specific tasks.

Figure A2. Definition of Competency Assessment for Neonatal Nurse Practitioners. From "Competencies and Orientation tool kit for neonatal nurse practitioners", 2nd ed. by the National Association of Neonatal Nurse Practitioners, 2014, p. 17.

Appendix B: Kotter's Model of Eight Steps to Lead Change

Figure 1. Kotter's Model of Eight (8) Steps to Lead Change. From "The heart of change", by J. P. Kotter and D. S. Cohen, (2002), Harvard Business Review Press, Boston, MA, p.6. Illustration from http://www.bing.com/images/search/?q=Army+Problem+Solving+Model&FORM=BRQONH on 12-11-14.

Appendix C: Institutional Review Board (IRB) Letter of Approval

Biomedical Sciences Institutional Review Board

Office of Responsible Research Practices
300 Research Administration Building
1960 Kenny Road
Columbus, OH 43210-1063

Phone (614) 688-8457
Fax (614) 688-0366
www.orrp.osu.edu

February 27, 2015

Protocol Number:	2014H0456
Protocol Title:	Assessment of Neonatal Nurse Practitioner Workload in a Level IV Neonatal Intensive Care Unit, Thelma Patrick, Carol Jaeger, College of Nursing
Type of Review:	Initial Review – expedited
IRB Staff Contact:	Adam McClintock Phone: 614-292-1159 Email: mcclintock.22@osu.edu

Dear Dr. Patrick,

The Biomedical Sciences IRB **APPROVED BY EXPEDITED REVIEW** the above referenced research. The Board was able to provide expedited approval under 45 CFR 46.110(b)(1) because the research meets the applicability criteria and one or more categories of research eligible for expedited review, as indicated below.

Date of IRB Approval:	February 26, 2015
Date of IRB Approval Expiration:	February 26, 2016
Expedited Review Category:	**5, 7**

In addition, the research has been approved for the inclusion of children, a waiver of the parental permission process, a waiver of HIPAA Research Authorization (entire research study), and a waiver of documentation of the consent process (for the NNP participants).

If applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

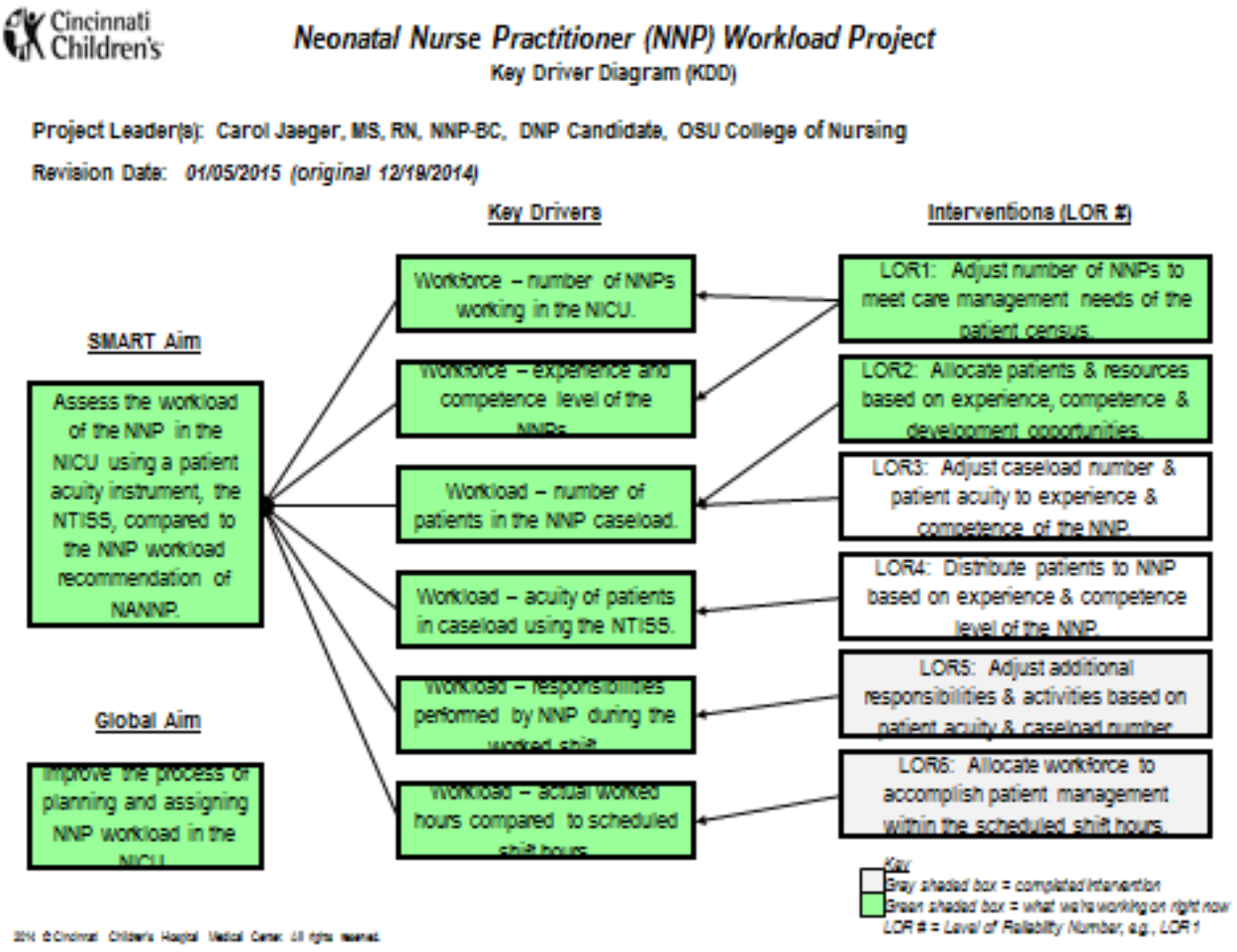
This approval is valid for **one year** from the date of IRB review when approval is granted or modifications are required. The approval will no longer be in effect on the date listed above as the IRB expiration date. A Continuing Review application must be approved within this interval to avoid expiration of IRB approval and cessation of all research activities. A final report must be provided to the IRB and all records relating to the research (including signed consent forms) must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University's OHRP Federalwide Assurance #00006378. All forms and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Karla Zadnik, OD, PhD, Chair
Biomedical Sciences Institutional Review Board

Appendix D: NNP Caseload Project - Key Driver Diagram



Appendix E: NNP Daily Shift Report

NNP Unique Project Identification Number: _____

Scheduled Shift: _____ Date

____ Day (0600h to 1800h)

____ Night (1900h to 0700h)

____ Non-caseload (0900h to 2100h)

Actual Shift Hours Worked: _____

Number of Babies Assigned in NNP Caseload for the Shift: _____

Neonatal Therapeutic Intervention Score (NTISS) for each Patient in Caseload:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Additional Responsibilities During the Shift:

_____ Precept Stu/Orientee
_____ Supervise Resident
_____ Supervise Fellow
_____ Supervise attendings
_____ Cover Resident Load
_____ Cover APRN Load
_____ Travel w/Patient
_____ Consult w/Sub-specialist
_____ Family Care Conference
_____ QI Activity
_____ Peer Review/Audit, i.e. OPPE/FPPE
_____ Standby for delivery(ies)
_____ Delivery Room attendance
_____ Crisis Event (code, death, safety)
_____ Education Activity (including mandatory)
_____ Mgmt/Coordination/Scheduling
_____ Other _____
_____ Other _____
_____ Other _____

At any time during the shift, did you have Safety Concerns because the NNP scheduled staffing com-promised or was inadequate to meet patient needs? _____ Yes _____ No

Was action taken to improve staffing? _____ Yes _____ No

Who provided the staffing support, i.e. physician, NNP, other? _____

NNP Level of Satisfaction with Performance at the end of the Shift: ('X'below appropriate number)

Very Satisfied (1) Satisfied (2) Neutral (3) Dissatified (4) Very Dissatisfied (5)

NNP Level of Satisfaction with Patient Outcome at the end of the Shift: ('X'below appropriate number)

Very Satisfied (1) Satisfied (2) Neutral (3) Dissatified (4) Very Dissatisfied (5)

Comments:

Appendix F: Neonatal Therapeutic Intervention Scoring System (NTISS)

ITEM	Subscore
Respiratory	
Supplemental oxygen	1
Surfactant administration	1
Tracheostomy care	1
Tracheostomy placement	1
Continuous positive airway pressure (CPAP)	2
Endotracheal intubation	2
Mechanical ventilation	3
Mechanical ventilation with muscle relaxant	4
High frequency ventlation	4
Extrcorporal membrane oxygenation(ECMO)	4
Cardiovascular	
Indomethacin administration	1
Volume expansion (≤15 ml/kg)	1
Vasopressor administration (1 agent)	2
Volume expansion (>15 ml/kg)	3
Vasopressor administration (>1 agent)	3
Pacemaker on standby	3
Pacemaker used	4
Cardiopulmonary resuscitation	4
Drug Therapy	
Antibiotic administration (≤2 agents)	1
Diretic administration (enteral)	1
Steroid administration (postnatal)	1
Anticonvulsant administration	1
Aminophylline administration	1
Other unscheduled medication	1
Antibiotic administration (>2 agents)	2
Diruetic administration (parenteral)	2
Treatment of metabolic acidosis	3
Potassium binding resin administration	3
Monitoring	
Frequent vital signs	1
Cardiorespiratory monitoring	1
Phlebotomy (5-10 blood draws)	1
Thermoregulated environment	1
Noninvasive oxygen monitoring	1
Arterial pressure monitoring	1
Central venous pressure monitoring	1
Urinary catheter	1
Quantitative intake and output	1
Extensive phlebotomy (>10 blood draws)	2

Metabolic/Nutrition	
Gavage feeding	1
Intravenous fat metabolism	1
Intravenous amino acid solution	1
Phototherapy	1
Insulin administration	2
Potassium infusion	3
Transfusion	
Intravenous gamma globulin	1
Red blood cell transfusion (≤15 ml/kg)	2
Partial volume exchange transfusion	2
Red blood cell transfusion (>15 ml/kg)	3
Platelet transfusion	3
White blood cell transfusion	3
Double volume exchange transfusion	3
Procedural	
Transport of patient	2
Single chest tube in place	2
Minor operation	2
Multiple chest tubes in place	3
Thoracentesis	3
Major operation	4
Pericardiocentesis	4
Pericardial tube in place	4
Dialysis	4
Vascular access	
Peripheral intravenous line	1
Arterial line	2
Central venous line	2

Gray, J.E., Richardson, D.K., McCormick, M.C., Workman-Daniels, K. and Goldmann, D.A. (1992). Neonatal therapeutic intervention scoring system: A therapy-based severity-of-illness index. *Pediatrics*, 90(4), 561-567.